MARINE REVIEW.

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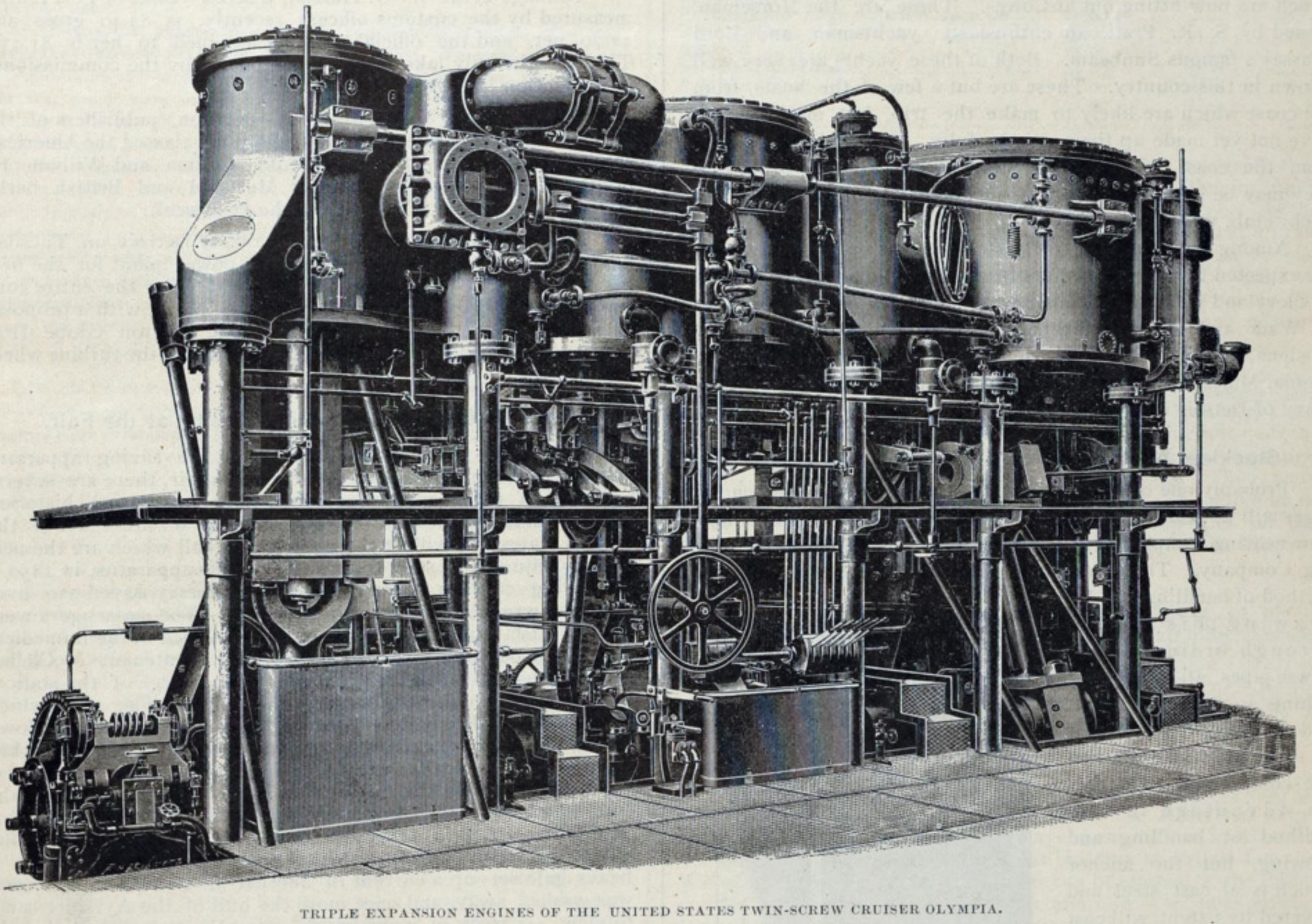
A Modern Lake Consort.

Although the number of consorts or schooners built on the lakes during the past few years has been limited, there has been no lack of improvements in this type of vessel. Steam windlass, steam capstan, steam deck hoist and steam pumps are a few of the features of progress in the modern schooner H. A. Barr, launched at West Bay City a few days ago. This boat is owned by W. C. Richardson, H. J. Webb, M. A. Bradley, and others of Cleveland, and is undoubtedly one of the finest wooden vessels on the lakes. She is 235 feet long, 35 feet beam and 19 feet hold, and has heavy steel keelsons and steel arches. Upon leaving the ways she was entirely equipped, even to the last details of cabin furniture, and has already begun service as the regular consort of the steamer J. H. Outhwaite. The Barr will carry 75,000 bushels of wheat from Lake Michigan, and cost, complete, $55,000.

Freight Contracts on Iron Ore.

Immediately following the sale of 400,000 tons of Norrie ore to the Carnegie Steel Company at about $3.85 a ton, some active chartering of vessels was begun in the Cleveland market, and contracts are recorded as follows: Ashland to Ohio ports, $1 a ton to Aug. 10 and Sept. 1; Marquette to Ohio ports, full season, $1; Marquette to Ohio ports, to Sept. 15, 90 cents. No contracts have been made from Escanaba, and although there is no definite knowledge to be had of anything having been done for the full season from Ashland, it is more than probable that the American Steel Barge Company and two other owners have taken some season business at $1. Two Harbors shippers want tonnage for the season at $1, and more contracts could be had now at the rates here named, but indications of improvement have appeared within the past few days, and the vessel owners, who are all set against contracting for the full season at present rates, are also inclined to refuse business for the summer months that would have been accepted last week. The announcement that the boats of the Inter-Ocean Transportation Company, which are controlled by stockholders in the Illinois Steel Company, are to enter the trade in ore to Ohio ports is not regarded as important, as the Illinois Steel Company, for reasons well known to the trade, will not take any ore until the beginning of next month.



TRIPLE EXPANSION ENGINES OF THE UNITED STATES TWIN-SCREW CRUISER OLYMPIA.

Engines of the Cruiser Olympia.

Triple expansion engines of the United States twin-screw cruiser Olympia, the largest cruiser as yet constructed for the United States navy, are shown in the accompanying engraving. The vessel was built and engined by the Union Iron Works, of San Francisco, the designs for the machinery having been prepared in the bureau of steam engineering, navy department, Washington. The vessel is 340 feet long and 53 feet wide and has a displacement of 5,500 tons. The proposed speed is 20 knots, which is to be reached with 13,500 indicated horse power. The engraving is taken from Engineering of London.

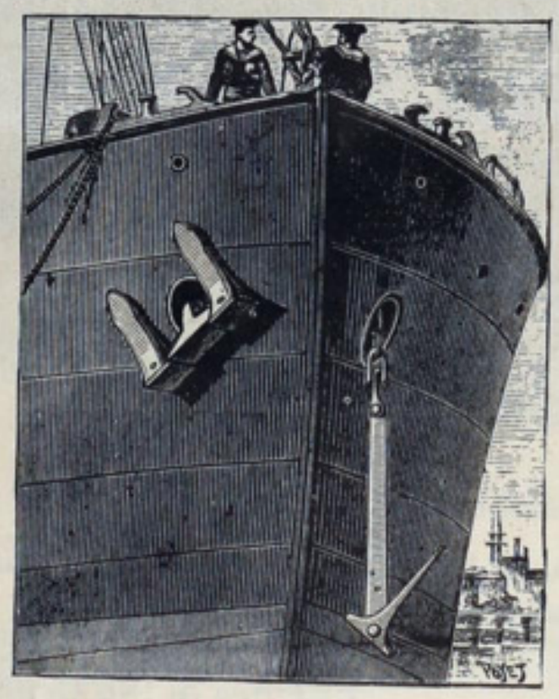
Yachts at the Fair.

Although the scheme for a club house, anchorage grounds, additional breakwaters and other elaborate accommodations for visiting yachts at the World's Columbian Exposition has had the support of men of unlimited wealth in Chicago, the plans outlined during the winter do not seem to be maturing very rapidly. The government work of insuring safe navigation for a very large number of vessels along the lake front between the city and the fair grounds is well under way, however, and though the great expectations of the Chicago yacht club may not be reached, it is very probable that the fair city will harbor a large fleet of elegant steam and sail yachts during the summer. The New York Times of recent date mentions among eastern yacht owners who have deeided to make the trip E. C. Benedict, with his steamer Oneida; William Dupont, with his new boat Au Revoir, which was launched at Wilmington, Del., a few weeks ago; J. Walter Thompson, who has hired for the summer Edward C. Potter's Halcyon, and possibly the Vanderbilt boat Conqueror. There are also a couple of English boats which are expected, and which are now fitting out at Cowes. These are the Norseman, owned by S. R. Pratt, an enthusiastic yachtsman, and Lord Brassey's famous Sunbeam. Both of these yachts are very well known in this country. These are but a few of the boats from the coast which are likely to make the trip, but most owners have not yet made up their minds fully. All the boats coming from the coast will probably start before June 1, in order that they may be home again in time for the cruise of the New York yacht club, which begins Aug. 14.

Among the owners of costly steam yachts on the lakes who are expected to join the visitors from salt water are H. M. Hanna of Cleveland with the Comanche, which is now on the coast; J. H. Wade and C. W. Harkness, also of Cleveland, with the Wadena and Peerless; Col. S. C. Reynolds of Toledo with the Sigma, Major W. B. Wetmore with the Lurline, and T. H. Newberry of Detroit with the Truant.

Stockless Anchors for One of the Bradley Boats.

Probably one of the first stockless anchors to be used on the lakes will be seen on the steel steamer Alva of the Bradley line, now nearing completion at the yard of the Cleveland Ship Building Company. The engraving illustrates the anchor and the method of handling it. By drawing this anchor through ordinary sized hawse pipes, all catting and fishing is dispensed with, and in letting it go all that is necessary is to slacken the compressor. There is an advantage in this method of handling and stowing, but the anchor which is of cast steel and covered by patent, will cost about double as much as the anchor now in general use on the lakes. It is used very extensively by sea-going vessels and yachts and is made in all sizes from 4 pounds to 6¼ tons. The patentee and manufacturer is Wasteneys Smith, 58, 59 and 60 Sand Hill, Newcastle-on-Tyne. The anchor has been on sale through a New York agent, but negotiations for its manufacture and sale on an extensive scale in this country are now pending.



Additional copies of the lithograph supplement of one of the new Northern line passenger ships accompanying this issue of REVIEW will be sent to any address for 40 cents each. In mailing the picture a tube will be used to protect it from injury.

In another part of this paper, Andrews, Hitchcock & Co., Cleveland, advertise for sale a number of steam cranes and other dock equipment.

Thomas Gregory, who has been appointed captain of the Cleveland viaduct under the new municipal administration, is a capable man. He sailed vessels out of Cleveland as far back as 1853.

Mayor Carter Harrison of Chicago is said to be of the opinion that the company organized to operate the Christopher Columbus and other passenger boats at Chicago during the exposition is trying to secure a monopoly of lake front dockage. He is disposed to oppose the company's operations.

Tonnage of the W. G. Harron, a screw vessel of Port Huron measured by the customs officers recently, is 84.40 gross and 42.20 net, and the official number assigned to her is 81,434. This was the only lake vessel passed upon by the commissioner of navigation last week.

The American Shipmasters' Association, publishers of the Record of American and Foreign Shipping, classed the American screw steamers City of San Antonio, Colima and William H. Gratwick, British screw steamer Mermaid and British barks Barbadian and Low Wood during the past week.

Bids were opened in Gen. Poe's office, Detroit, on Tuesday of last week for furnishing the turbine power plant for the new 800-foot lock at the St. Mary's Falls canal. For the entire contract Hughes Bros. & Bangs of Syracuse, N. Y., with a proposal of $37,691, were the only bidders. The Dayton Globe Iron Works of Dayton, O., bid $5,663 for furnishing the turbine wheel and fittings.

A Feature of the Life Saving Exhibit at the Fair.

Besides the exhibits of all the latest life saving apparatus contained in the new station at the world's fair, there are several exhibits of older appliances which have interesting histories. Among them is the first life car ever used on the coast of the United States and with it the mortar and ball which are the necessary adjuncts to such work. With this apparatus, in 1850, a life-saving crew on Square beach, New Jersey, saved 250 lives from the wrecked British ship Ayrshire. The passengers were mostly Irish immigrants, some of whom settled in the immediate neighborhood, and it was from them that Lieutenant McClellan of the revenue marine service, who is in charge of the station, got the story which he tells about the relics. The shot which weighs twenty-five pounds, struck the deck and bounded down one of the hatches, striking a woman between the shoulders, but doing her no injury beyond giving her a great scare. In the excitement attending the rescue the ball was detached from the line which it carried to the ship when fired out of the mortar. The hulk settled in the sand, and like all such incidents the wreck was soon forgotten. In 1875, twenty-five years after, a heavy gale set up a current in another direction and the sand was washed away, and once more the hull of the Ayrshire came to view. A party of wreckers in going through the ship's hold came across the old rusted cannon ball. Its presence excited no little comment among the wreckers, and when they went ashore they told their story of the strange find in the hold of the Ayrshire. There were some of the people who came over in the ill-starred ship still living in the neighborhood and they soon explained the presence of the big twenty-four-pound cannon ball. It was sent to the Smithsonian Institute in Washington, where with the curious-looking old mortar and the life car it has since remained. Only one life was lost in the rescue of the passengers and crew of the Ayrshire. It was that of a man who became too impatient to wait for his turn to go inside the car and insisted on going ashore on the outside. A heavy wave turned the car over and he was washed off and drowned.

Buffalo Grain Business.

BUFFALO, N. Y., May 11.—Last week Buffalo retained the single satisfaction of having kept the fairly good opening coal rate intact, though shipments dropped off badly, but now the rates have broken down completely, especially to Lake Superior. Some shippers declined to send any coal to Lake Superior, on the ground that it would all come in behind the large amount of soft coal already on the way. The elevators have been lucky enough to come out about even with the early grain fleet. For the sake of peace it is to be hoped that grain receipts will continue light for a week or more.

The slow movement of business at the terminal ports has given the waiting steamers a fine chance to skip up to Toledo and bring down cargoes of grain. This is fast driving the canal schooners to Lake Ontario and will soon drive them out of existence. The steamers are getting very sick of the Toledo trade, for shortages have been very exasperating, often exceeding a bushel to the thousand, while vessels from Chicago taking the very next turn at an elevator would overrun.

While it can not be said that the new Cleveland and Buffalo line of steamers is making a fortune, yet it is true that some encouragement has been given the enterprise by the patronage, which is more than can be said of the marine of the lakes in general. When the two steamers were put on the route there were grave doubts here as to their being able to make the trip in time to satisfy night passengers. The Sunday night trip of the State of Ohio has happily dispelled all doubt, as she made it in 11 hours and 20 minutes, which is really good time.

Another week of lumber receipts has passed without much of a war between the stevedores and the lumber shovers' union. Personal assaults on single non-union men caught away from the work have made up the sum of outbreaks, which were on all hands expected to develop something large, especially at Tonawanda. If the union is held at arms' length much longer it will have to go to pieces, by way of a sort of left-handed self-defense.

Buffalo is again becoming a great tug building port. There was a day when David Bell and George Notter about monopolized this branch of the building industry of the lakes. When George Notter died several years ago his name stood far in the lead in the number of tugs he had built. Mr. Bell has since built several, and now the Union ship yard and O'Grady & Maher have six between them under way, three for Buffalo, two for the V. O. T. line Cleveland, and one for Tonawanda. One of the V. O. T. line boats, the Chris Grover, was launched Saturday.

The Choctaw Accident.

Editor MARINE REVIEW: Yours of recent date relative to the accident on the Choctaw was duly received. I can not say very much for publication without a more definite knowledge of the circumstances, together with scale drawings of the parts, or better still, an opportunity of personal examination. The question naturally divides itself into two parts: First, could this method of making a joint lead, under conceivably possible or probable circumstances, to the rupture of the flange; second, is this the probable explanation of the accident on the Choctaw?

In regard to the first question, I would say that under usual or probable circumstances it seems perfectly possible that a flange might be broken in this way. In the case mentioned the bolts were pitched about 4 inches. If we assume an average leverage of one inch from the edge of the gasket, with a fair value of the strength of the cast iron, then it appears from computation that the flange should be 1.7 inches thick in order to have equal strength with the bolts. If the flange were thinner (as it probably was, or the leverage greater, or the spacing less, the flange would be the weaker and could be broken by setting down sufficiently on the nuts. Irregular strains due to unequal expansion and contraction may also have had much to do with the matter.

In regard to the second question, I can, of course, form no definite opinion other than to say that it seems quite possible. I note in the article as published in the REVIEW, some numerical errors, as well as a statement which is not quite correct. The dimensions of the cover inside are stated to be 17 by 42, giving 375 square inches. This should be, of course, 714. Multiplying this by 160, we have as the total load 114,240 instead of 117,600, as printed. The statement in question is that the pressure on the inside of the cover added to that already on the bolts would constitute the total load tending to break the flange. The addition to the cross-breaking load on the flange due to internal pressure would be very slight, so long as the total load was less than the total stress on the bolts. The existence of this pressure leads to a very slight increase in the tension on the bolts, and to a very considerable reduction in the pressure between the flange and the gasket. The sum of these two will equal the total steam pressure. The increase in bolt tension will slightly add to the cross-breaking load, but such addition will be but a small fraction of the total steam pressure. I will not attempt to explain this in detail here. It is a question of mechanics and would require more space than I will take at this time.

W. F. DURAND.

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Record of Speed and Big Cargoes.

[*Masters or owners of freight boats are invited to report improvements on this list.*]

Iron ore: Maritana, Minnesota Steamship Company of Cleveland, 4,260 gross or 4,771 net tons, Escanaba to South Chicago; Maryland, Inter-Ocean Transportation Company of Milwaukee, 3,663 gross or 4,103 net tons, Escanaba to South Chicago, draft 17 feet 4 inches.

Grain: Selwyn Eddy, Eddy Transportation Company of Bay City, 139,820 bushels of wheat, Detroit to Buffalo; E. C. Pope, Eddy Transportation Company of Bay City, 125,730 bushels of corn, Chicago to Buffalo; Onoko, Minch estate, Clevelond, 187,657 bushels of oats, Chicago to Buffalo.

Coal: E. C. Pope, Eddy Bros. of Bay City, 3,950 net tons anthracite, Buffalo to Chicago.

Speed: Owego, Union Line of Buffalo, Buffalo to Chicago, 889 miles, 54 hours and 16 minutes, 16.4 miles an hour.

Iron Mining.

VALUE OF LEADING STOCKS.

Quoted by Chas. H. Potter & Co., No. 104 Superior St. Cleveland, O.

Stocks.	Par Value.	Bid.	Asked.
Cleveland-Cliffs Iron Company	$100 00	$ 56 00	$ 60 00
Champion Iron Company	25 00	28 00	.....
Chandler Iron Company	25 00	.....	39 00
Jackson Iron Company	25 00	.....	38 50
Lake Superior Iron Company	25 00	31 00	.....
Minnesota Iron Company	100 00	.....	64 50
Pittsburgh & Lake Angeline Iron Co.	25 00	.....	140 00
Republic Iron Company	25 00	.....	9 75
Ashland	25 00	.....	.....
Section Thirty-three	25 00	1 00	.....
Brotherton	25 00	2 00	2 50
Iron Belt	25 00	2 40	2 75
Aurora	25 00	6 50	7 00

In one day, twenty-four hours, of last week 3,200 gross tons of ore were hoisted from the several shafts of the Chapin mine. This is the largest day's work in the history of the mine. As the Chapin company has sold the bulk of its 1893 product at a price that is proportionally better than the figures paid so far for standard Bessemers, it is more than probable that the mine, as well as the other Schlesinger properties, will be worked to full capacity. Active shipments of this ore from Escanaba were begun with the first opportunity.

Colgate Hoyt and C. W. Wetmore of New York, E. W. Oglebay of Cleveland, P. L. Kimberly, John McKinley and others connected with the combination which includes stockholders in the American Steel Barge Company and Missabe range mining companies were on the range last week. They were accompanied by A. L. Dickerman and W. J. Olcott, active managers of the Wisconsin Central syndicate properties on the Gogebic, who will spend some time looking over the Missabe mines.

Shipments of a few more than 1,000 car loads, or about 20,000 gross tons, had been made by the Cincinnati mine, Missabe range, up to May 1.

Mining operations were resumed at the Claire mine, Crystal Falls district, with the opening of the present week.

In General.

The Cramps and International Navigation Company may be depended upon to put power enough into the American ships now building at Philadelphia to have them rank in speed with the new Cunarders and the leviathan building at Belfast for the White Star company. From all that can be learned of the Philadelphia boats, it would seem that the aim now is to take advantage of all features of the latest practice that will tend towards high speed.

Lights on the buoys marking the channel for world's fair passenger traffic between the city of Chicago and the fair grounds will be operated by an alternating current of 1,460 volts. The cable will be fourteen miles long, and is said to be the longest cable in the world carrying an alternating current of equal pressure.

"Why, said a sailor, speaking of a locomotive, "there's nothing manly about it. Watch a ship, now, with her canvas filling out, laying down to it just enough to show she feels the breeze, tossing the spray away from her bows, and lifting her head over the seas, as if she stepped over 'em. There's something like life there. But that there concern comes insinuating, sneaking and snorting along like a thundering long snake with a pipe in his mouth."—American Shipbuilder.

Northern Line Ships.

An elegant lithograph supplement of one of the two passenger ships being built by the Globe Iron Works Company, Cleveland, for the Northern Steamship Company, is presented with this issue of the REVIEW, and in another part of the paper there is printed, with illustrations, an article relative to the Belleville boilers, which is contributed by Miers Coryell, the representative in the United States of the French owners of patents on this kind of generator. Considerable information about these steamers and their twin sets of quadruple expansion engines of 7,000 horse power has been given in previous issues of the REVIEW, but interest in them increases with the progress of work on hulls, machinery and boilers, as they are to be far in advance of anything as yet accomplished by lake builders, and in the matter of power will represent a higher practice than will be attempted in the American line ships just begun by the Cramps.

The first of the boats, which is now about fully plated, will be launched about Aug. 1, and it is expected to have machinery and boilers fully installed by Oct. 1, so as to permit of the cabin work and other detail being finished for the opening of navigation in 1894. Frame work on the second boat is about finished, and a plant has been fitted up and a large part of the pipe work for the boilers gotten under way. Engines for the first of the boats are also well advanced and some of the parts are enormous. The castings making up the beds for one set of engines weigh full fifty tons, and the low pressure cylinders weigh about seventeen tons each.

General Manager Gordon and Mr. Gordon, Jr., who were in Cleveland during the week have about concluded the last important details relative to the cabins, which are to be almost entirely of mahogany. Not least among the attractive features now being considered for the cabins are numerous panels containing reproductions from photographs of scenery along the line of the Great Northern Railway.

The electric light plant, to be installed by the Fisher Electric Company of Detroit, will be superior to that of the Campania and probably to any vessel afloat. There will be in each ship three sets of direct-connected triple expansion engines and dynamos. This machinery will in itself be a wonderful representation of mechanical skill. In these installations an effort will be made to obtain the highest degree of coal economy possible. Each set of engines and dynamos will be of 400 sixteen-candle-power lights capacity. This will represent a radical departure from the methods heretofore in vogue of employing simple high pressure belted engines and dynamos. If simple high pressure engines were used, the cylinder dimensions would be 9x12 and the sum of the diameters of the three electric lighting engines would equal the diameter of one of the large driving engines. The coal consumption of these three engines would be 480 pounds per hour.

The diameter of the high pressure cylinder of the direct connected engines will be 3⅞ inches, and the three engines will require 180 pounds of coal per hour. They will be automatic, of the pillar three-crank type, and will be equipped with self-oiling bearings, automatic relief valves and other necessary appliances. The dynamos will be of the automatic compound type, operating from full to no load without adjustments, and the brushes have a fixed point of commutation. The space occupied is another strong argument in favor of the direct-connected plants, as each engine with dynamo attached will occupy a space not to exceed 36 inches wide by 98 inches long. A belted outfit of the same capacity would require a space 6½ feet wide by 16 feet long. The largest plant now on a passenger steamer on the lakes is one of 650 lights on the steamer City of Detroit, while these boats, as explained, will each have 1,200 sixteen-candle-power lamps. Each stateroom will be equipped with at least one lamp, and special rooms will be furnished with clusters of two or more.

Each boat will be divided into twenty-eight main circuits, as follows, requiring twenty-six miles of marine core wire: Emigrants' quarters, 1; coal bunkers, 2; boiler room and fire hold, 2; lower engine space, 1; baggage, waiters' and crew's space, 1; main deck, starboard, 1; main deck, port, 1; secondary circuits, dining room, 6; upper engine room, 1; vestibule and aft departments, 1; forward state rooms, 4; aft state rooms, 4; hurricane deck, state rooms aft, 2; officers' quarters forward, 1; total, 28. On the spar deck each cluster light in the ceiling will be placed on an independent circuit. All circuits will be controlled by "quick-break" switches. The switches controlling the main circuits will be placed on a marble switch-board located in the engine room, and the method of switching will be so arranged that the load can be placed on one machine, provided the capacity on the dynamo is not exceeded; or the load can be divided equally and automatically between the three sets. A six-circuit auxiliary switch-board will be placed in the dining room to control the cluster lights. The entire system of wiring will be placed in moulding and thoroughly protected by safety devices. Automatic signal lamps of 100 candle power will be used with the Fisher Electric Company's alarm attachment. The Campania, 620 feet long and 65 foot beam, employs only 1,360 lights, while these boats, which are but 380 feet long, will have 1,200 lights, and their direct connected plants show a practice in advance of that followed on the Cunard liner.

Every part of these vessels is as much American as the International line ships, to which Congress and the whole country has been giving attention. Plates, beams, angles, forgings and all other steel and iron parts of hull and machinery are from the Otis Steel Company, Cleveland Rolling Mill Company and Cleveland City Forge, and the Pencoyd Iron Works of Philadelphia and Bridgeport Malleable Iron Company of Bridgeport, Conn. Immense quantities of tubing for the boilers are from the Syracuse Tube Company, Syracuse, N. Y., and the Cuban mahogany and west coast primavera for cabins is prepared by the Martin-Barris Company of Cleveland. The construction and inspection of the vessels is under the rules of an American society, also, the United States Standard Owners,' Builders and Underwriters Association of New York.

The Aurora's Steam Towing Machine.

Mr. John Corrigan, owner of the steamer Aurora, says that the steam towing machine put onto that vessel by the American Ship Windlass Company of Providence, R. I., worked very successfully on the steamer's last trip from Chicago to Buffalo. The automatic portion of the apparatns is in need of a little care in adjustment, he says, but he does not think that a matter of importance, and is of the opinion that after a few trips with the machine on the Aurora it will be adopted by a number of lake steamers, as it is especially fitted to the service here. The Dominion Coal Company, of Boston, has just ordered two of the machines.

From an advance copy of the 1893 Ship Masters' Directory it is seen that it will be a very handsome book, containing the names, addresses and pennant number of over 900 captains of the better class of lake steamers, arranged in alphabetical and numerical order. In addition to four or five pages of illustrations there are several pages of reading matter showing the present condition and progress of the association. The book is handsomely bound and lettered in gold. The grand financial secretary certainly deserves credit for the preparation of such a book.

General Manager Gordon of the Northern line, Mr. Gordon, Jr., and Miers Coryell spent a couple of days of last week at the ship yard of the Globe Iron Works Company, Cleveland; concluding details of the cabin work on the new Northern line passenger ships.

Miles-Ton Report, St. Mary's Falls Canal.*

UNITED STATES ENGINEER OFFICE,
34 West Congress Street, Detroit, Mich., May 1, 1893.

Brig. Gen. Thomas L. Casey, Chief of Eng'rs, U. S. A., Washington, D. C.

Sir: I have the honor to submit the following discussion of statistics connected with operating and care of St. Mary's Falls canal, Mich., during the season of 1892. The deductions are similar to those submitted each year since 1887. The prime object has been, as usual, to obtain cost of carrying a ton of freight one mile; taking as a basis the entire traffic to and from Lake Superior, which has passed the canal and was reported in proper form to the management. The methods used to obtain this result are precisely the same as in previous years, and which have been given in former reports in minute detail.

The results have been carefully compared and checked, and I believe are as nearly correct as they can be made from the data in possession of this office, connected with the freight rate on the traffic, which was necessarily obtained from outside sources. In this connection an endeavor was made to make the reports of shippers, owners and managers more general than in former years, by enlisting their interest as members of the Lake Carriers' Association; by calling to their notice, through the secretary of the organization, the importance of their doing their share in furnishing complete and reliable data on the points on which they alone were fully informed. I am sorry to say that this endeavor was not successful, and that circulars were replied to by only twenty-one individuals and firms; or exactly the same number as were received for the previous year. I consider the class of information thus obtained fully up to the standard of former years, and sufficiently complete to answer our purpose. The data thus obtained shows the following mean rates of freight: †Miscellaneous merchandise, $3.60 per ton; coal, 41 cents per ton; flour, 16½ cents per barrel; wheat, 3 6-10 cents per bushel; grain, (other than wheat) 3¾ cents per bushel; manusactured iron, $2.15 per ton; pig iron, $1.23 per ton; salt, 15 cents per barrel; copper, $1.40 per ton; iron ore, $1.00 per ton; lumber, $2.95 per 1,000 feet, broad measure; silver ore and bullion, $2.25 per ton; building stone, $1.67 per ton; average cost per ton, $1.08.

After the average rate had been adopted, a table was formed from which was obtained the total amount paid for the transportation of freight passing through the canal during the season of 1892, which was $12,072,850.88.

COST OF CARRYING FREIGHT PASSING THROUGH ST. MARY'S FALLS CANAL.

ITEMS.	UNIT.	QUANTITY.	PRICE PER UNIT.	AMOUNT.
Coal	Tons.	2,904,266	41	$1,190,749 06
Flour	Bbls.	5,418,135	16½	893,992 27
Wheat	Bus.	40,994,780	03.6	1,475,812 08
Grain, other than wheat	Bus.	1,666,690	03¾	62,500 87
Manufactured iron	Tons.	59,772	2 15	128,509 80
Pig iron	Tons.	41,748	1 23	51,350 04
Salt	Bbls.	275,740	15	41,361 00
Copper	Tons.	64,993	1 40	90,990 20
Iron ore	Tons	4,901,132	1 00	4,901,132 00
Lumber	M.ft b.m	512,844	2 95	1,512,889 80
Silver ore and bullion	Tons.	1,930	2 25	4,342 50
Building stone	Tons.	39,698	1 67	66,295 66
Miscellaneous merchandise	Tons.	459,146	3 60	1,652,925 60
				$12,072,850 88

NOTE—In these tables "tons" means net tons, or tons of 2,000 pounds.

The total amount of freight paid, $12,072,850.88, divided by the total mile-tons, 9,222,773,938, gives the cost per mile per ton as 1.31 mills. The average distance freight was carried was 822.4 miles, which was 2 miles greater than in 1891.

The nature of the data from which the preceeding result was found is such that it includes the cost of loading and unloading. Other results were obtained as follows:

Total miles-tons	9,222,773,938
Total freight paid	$12,072,850.88
Cost per mile per ton	1.31 mills.
Average distance freight carried	822.4 miles.
Average cost per ton for carrying freight	$1.08

The number of registered craft which used the canal during this season was:

Steamers	460
Sails	275
Total	735

AMERICAN CRAFT.

CLASS.	NO.	Registered Tonnage.	Freight Tonnage.	Number of Passengers.	Valuation.
Steamers	414	362,542	7,618,230	13,755	$30,613,300
Sail	254	156,853	3,164,961	.....	5,606,800
Total	668	519,395	10,783,191	13,755	$36,220,100

CANADIAN CRAFT.

Steamers	46	20,881	342,247	12,141	$1,878,200
Sail	21	9,296	77,480	.....	230,500
Total	67	30,177	419,727	12,141	$2,108,700

The total freight carried by American unregistered craft amounted to 1,877 net tons in 138 passages, and the total freight carried by Canadian unregistered craft amounted to 9,538 net tons in 89 passages, making an average of 50 tons and 573 pounds of freight per passage. The Canadian freight is 3.8 per cent. of the total freight of the season.

SUMMARY.

Total number of registered craft	735
Total passages by unregistered craft	519
Total freight carried by registered craft	11,202,918tons
Total freight carried by unregistered craft	11,415tons
Total passengers	25,896
Valuation of craft (registered)	$38,328,800

The Canadian freight amounted to 429,265 tons, which is 3.8 per cent. of the total freight.

The total passages for the season amounted to 12,580 and 1,887 of these were by 88 crafts under 100 tons register. Their aggregate register tonnage was 2,553 and their average tonnage 29 tons. The freight carried during the season by these crafts, only amounted to 1,845 tons.

From the column of largest cargoes it is ascertained that there were 121 propellers that carried in their largest load 2,000 tons and upwards, and that these 121 cargoes aggregated 291,739 tons, and averaged 2,411 tons. There were thirty-seven propellers that carried in their largest load, 2,500 tons and upwards, aggregating 102,389 tons and averaging 2,767 tons. Twenty-four sail vessels carried 2,000 tons and upwards, aggregating 58,636 tons and averaging 2,443 tons. Twelve whaleback tow barges (rated in reports as sailing vessels) carried 2,500 tons and upwards, aggregating 32,956 tons and averaging 2,746 tons.

The greatest number of miles run during the season is to the credit of the propeller Thomas W. Palmer of Detroit, Mich., and amounted to 48,044 miles. The greatest amount of freight carried during the season is to the credit of the propeller Castalia of Cleveland, O., aggregating 82,309 net tons. This boat earned the same credit last season. The greatest number of miles-ton for the season is to the credit of the propeller Northern Queen of Buffalo, N. Y., and is 6,553,900. This boat has the same credit three seasons in succession. The largest single cargo carried during the season is to the credit of the propeller Maritana of the Minnesota Steamship Company, and amounted to 3,580 tons. The largest single cargo carried by a sail vessel (so rated in our reports) is to the credit of the Huron Barge Company's tow barge Sagamore, and amounted to 3,354 net tons.

The canal was opened to navigation during the season of 1892, 233 days, which exceeded the time for 1891 by 8 days.

The amount of freight carried during the season of 1892 exceeded that of the previous season by 2,325,744 tons or 26 per cent. and the amount paid for carrying the freight was $2,223,828.07 greater than in 1891.

It is found by the discussion of the records of the watchmen stationed at the head and foot of the canal, that vessels were delayed at the canal a total of 63,361 hours and 56 minutes; that 48,025 hours and 6 minutes (or an average of 3 hours and 49 minutes) were legitimate delays, and that 15,336 hours and 50 minutes of the total time were occupied by vessels for their own convenience. These records also show that vessels were detained only 13 minutes on account of the railroad swing-bridge being closed, and that the closing of the bridge was only delayed by boats 6 hours and 17 minutes.

The work on this report has required the labor of three assistant superintendants and five office watchmen during the entire winter, and the greater part was done under the supervision of John McMahon, the office assistant, which was rendered necessary by the sickness and absence of Clerk Andrew Jackson. His familiarity with the work and his careful method of checking, assure its correctness.

Very respectfully,

O. M. POE,
Colonel, Corps of Engineers,
Brvt. Brig, Gen. U. S. A.

*This report is published with the permission of the war department and through the kindness of Gen O. M. Poe.

†Table of average rates on different kinds of freight and explanation of method of determining them, which the report contains, is omitted, as same method has been used for several years past.

Trade Notes.

Clayson's crank pin oil is recommended in place of lard oil for numerous reasons, which will be given on application to the Commercial Oil Company, Buffalo, N. Y.

Bills for paints of all kinds form an important item in the expense account of lake vessel owners, dock owners and managers of summer resorts. A well-established and reliable concern making cheap, handsome and durable materials is the Atlas Paint Company of Pittsburg, Pa., manufacturers of iron oxide and mineral paints and colors, and also lead and zinc paints, all kinds of blacks, Japans and exterior and interior varnishes and finishes. The Pittsburg Varnish Company, one of the oldest concerns of its kind in the country, is now operated by stockholders, who also control the Atlas company. A large advertisement from this firm appears elsewhere in this issue.

MARINE REVIEW.

DEVOTED TO THE LAKE MARINE AND KINDRED INTERESTS.

Chicago Office, Western Union Building, 110 LaSalle Street.
Published every Thursday at No. 516 Perry-Payne Building, Cleveland, O.

SUBSCRIPTION—$2.00 per year in advance. Single copies 10 cents each. Convenient binders sent, post paid, 75 cents. Advertising rates on application.

The books of the United States treasury department contain the names of 3,657 vessels, of 1,183,582.55 gross tons register in the lake trade. In classification of this fleet the lakes have more steam vessels of 1,000 to 2,500 tons than the combined ownership of this class of vessels in all other sections of the country. The number of steam vessels of 1,000 to 2,500 tons on the lakes on June 30, 1892, was 321 and their aggregate gross tonnage 534,490.27; in all other parts of the country the number of this class of vessels was, on the same date, 217 and their gross tonnage 321,784 64. The classification of the entire lake fleet is as follows:

Class.	Number.	Tonnage.
Steam vessels	1,631	763,063.32
Sailing vessels	1,226	319,617.61
Canal boats	731	75,580 50
Barges	69	25,321.12
Total	3,657	1,183,582.55

Tonnage built on the lakes during the past five years, according to the reports of the United States commissioner of navigation, is as follows:

	No. of boats.	Net Tonnage.
1888	222	101,102.87
1889	225	107,080.30
1890	218	108,515.00
1891	204	111,856.45
1892	169	45,168.98
Total	1,038	473,723.60

ST. MARY'S FALLS AND SUEZ CANAL TRAFFIC.

	St. Mary's Falls Canal.			Suez Canal.		
	1892.	1891.	1890.	1892.	1891.	1890.
No. vessel passages	12,580	10,191	10,557	3,559	4,207	3,389
Ton'ge, net regist'd	10,647,203	8,400,685	8,454,435	7,712,028	8,698,777	6,89[illegible],014
Days of navigation	223	225	228	365	365	365

Entered at Cleveland Post Office as Second-class Mail Matter.

THE following paragraph, which seems to be of more than ordinary interest, was found among a number of the routine reports on the iron market in last week's issue of the American Manufacturer, of Pittsburg, a journal that represents the furnace interests of Pennsylvania: "Whether the deadlock of so long standing in the ore trade will result in an organized and well capitalized effort to establish additional sources of ore supply is a question which it would be impossible at this time to say much about. The present ore magnates, however, would perhaps be surprised if they knew what plans have been suggested with reference to the removal of the annual squabble over ore freights and prices. Of course the control of the great bulk of ore land is well known, but buyers are not so far removed from resources as might be supposed. Free ore may be put down as a fact for east-of-mountain consumers, as well as free soft coal and lower freight rates for both. The fact might as well be accepted in advance that the agencies now at work will bring about a reduction of ore prices." The foregoing was not written by a novice in the office of the Manufacturer. The developments of the past week have shown that the pig iron manufacturers, whether working under concerted plans or not, have removed the "annual squabble over ore freights and prices," by bringing the producers of ore down to prices in which there is a margin of profit for only a few of the wealthy and highly prosperous mining companies. Another cut this year of almost a dollar a ton in prices of ore brings home to vessel owners of the lakes as well as the ore men the serious subject of almost unlimited power in the hands of big corporations like the Illinois and Carnegie steel companies.

FINANCIAL troubles of the Toledo Ann Arbor & Northern Michigan Railway Company have undoubtedly put an end to the plans of the directors of the company to build more car ferries, and especially the vessels which it was proposed to run on Lake Erie between Buffalo and Toledo. Although all reports about the Buffalo–Toledo line was denied, it is nevertheless true that such a project was contemplated by the management of the company. The scheme was to secure a direct connection between the Delaware, Lackawanna & Western and the Northern Pacific by way of the Ann Arbor, with its ferry steamers on Lake Michigan and proposed line on Lake Erie. The success of such a venture would, however, be doubtful at the best. Even now it is a question whether the distance employed in the Lake Michigan route, with its disadvantages on account of weather, will not render it a losing undertaking, notwithstanding the great saving in the number of miles between terminals. Between Buffalo and Toledo the lake line would measure about mile for mile with the railways, and aside from the possible necessity of resorting to the water route in order to make the Lackawanna-Northern Pacific connection, the whole scheme is pronounced by those who have investigated the subject of car ferries unworthy of consideration.

TWENTY-EIGHT pages are contained in this issue of the MARINE REVIEW, and the numerous engravings and lithograph supplement alone represent an expenditure of full $500. We have not pulled any bell cords to gratify our own feelings of greatness, and hope this short note calling attention to progress in the REVIEW will be excused on the score of pardonable pride.

Iron Ore on Lake Erie Docks.

On account of the unsettled condition of the sales market no correct statement of iron ore on Lake Erie docks on either April 15 or May 1 of this year was made public, although the condition of stocks was known to the ore sales agents who are most interested in such matters. The figures covering date of April 15 are given below as a matter of record:

ORE ON DOCK AT LAKE ERIE PORTS.

Ports.	April 15, '93. gross tons.	April 15, '92. gross tons.
Buffalo	56,128	66,734
Erie	255,053	129,573
Ashtabula	766,737	512,125
Fairport	328,753	296,990
Cleveland	713,392	445,887
Lorain	110,000	130,000
Huron	20,679	10,645
Sandusky	79,716	88,800
Toledo	22,150	69,502
Total	2,352,608	1,750,256

The above figures show an increase of 602,352 tons over stocks on the corresponding date in 1892. On April 15, 1891, stocks on all docks aggregated 2,708,421 tons, or 355,813 tons more than on April 15, 1893. The figures for the three years are:

April 15,	On all Lake Erie Docks gross tons
1893	2,352,608
1892	1,750,256
1891	2,708,421

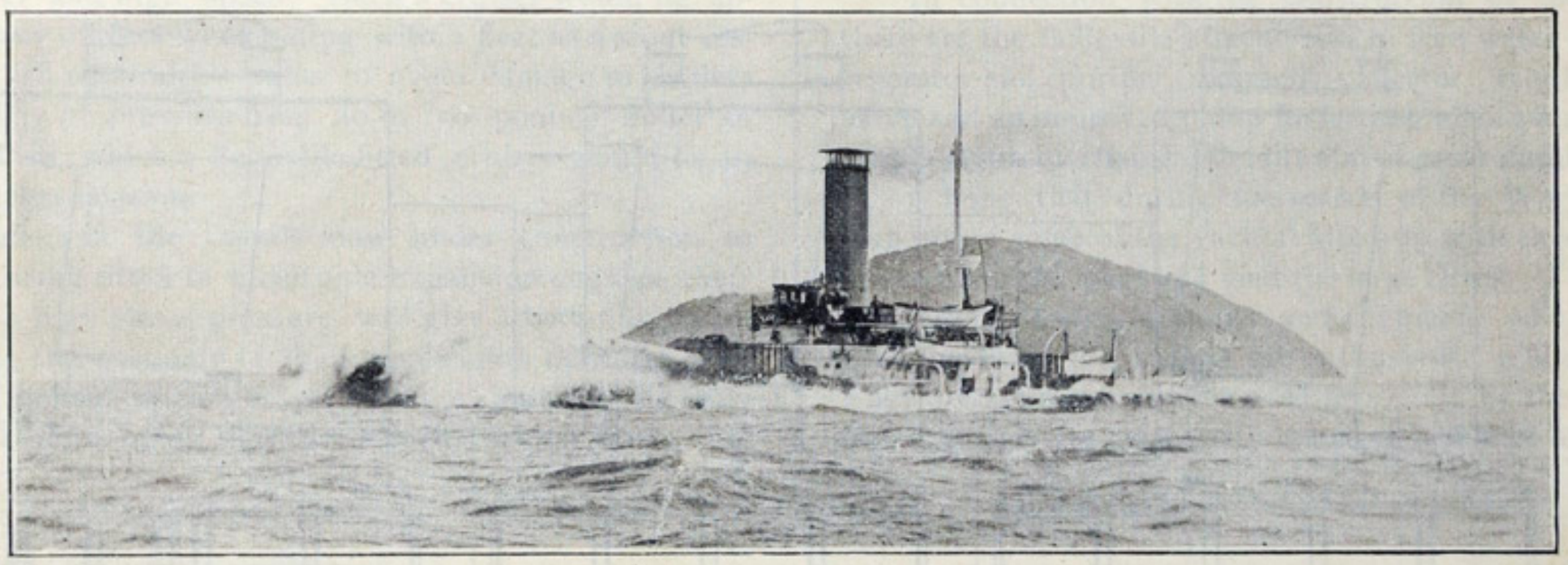
The following shows consumption from Lake Erie docks during the year ending April 15, 1893:

	Gross tons.
On dock at opening of navigation in 1892,	1,750,261
Receipts at lower lake ports during season of 1892,	6,660,734
Total	8,410,995
On dock April 15, 1893	2,352,608
Consumption year ending April 15, 1893	6,048,387

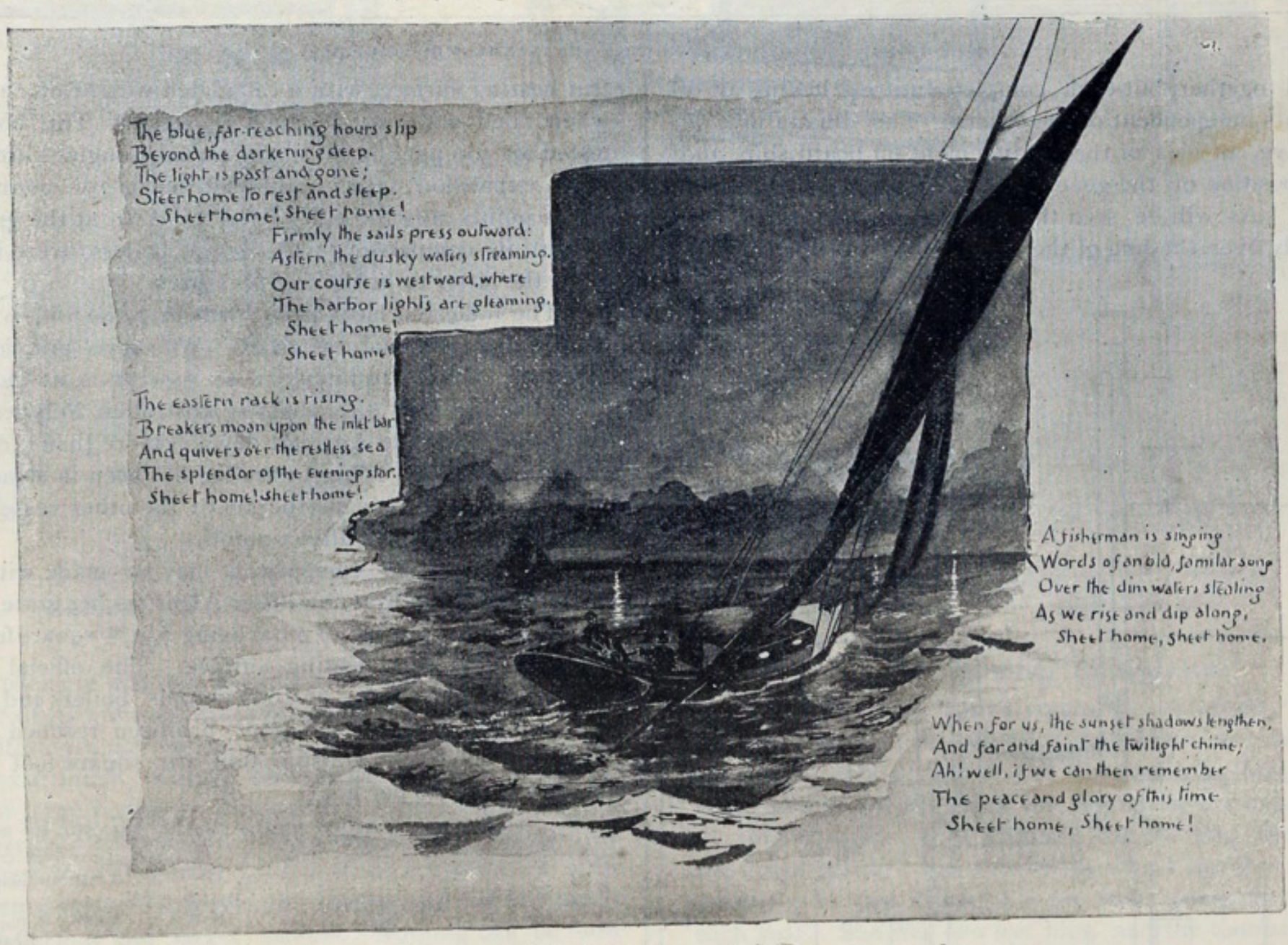
The amount of ore on dock on May 1, 1893, fifteen days after the date of the foregoing statement, was in round numbers 2,050,000 tons, against 1,537,188 tons on May 1, 1892, and 2,662,223 tons on May 1, 1891. This shows that the surplus over 1892 was decreased materially by an active movement to furnaces during the latter part of last month. The statement entire shows that consumption during the year ending with the opening of navigation in 1893 was greater than during any previous year in the history of the ore business.

Two Interesting Marine Views.

Two attractive views of a marine nature appear on this page. The first represents the U. S. cruiser Monterey on her trial trip, and is reproduced from one of several photographs taken while the boat was running under great speed. The Monterey is one of the naval vessels built by the Union Iron Works of San Francisco. We are indebted to the Rudder of Watertown, N. Y., for the lower picture entitled "Homeward Bound."



UNITED STATES CRUISER MONTEREY ON SPEED TRIAL.



"HOMEWARD BOUND."

Barge Company's Relations to Conneaut Dock Company.

It has been repeatedly said that the iron ore and coal docks that have been built up at Conneaut, Lake Erie, within the past year, in connection with the Pittsburg, Chenango & Lake Erie Railway, will receive all the ore mined in the Missabe range by the mining syndicate in which the eastern stock-holders of the American Steel Barge Company are interested. Anyone acquainted with the business of transporting ore from the Lake Superior region to the furnaces of Pittsburg and Ohio will readily understand that this is impossible, as the purchasers of the ore have the right by contract to say where it shall be delivered. Mr. E. W. Oglebay of Oglebay, Norton & Co, Cleveland ore sales agents, is president of the Conneaut dock company, and the stock of the company is about equally divided between the railway and furnace owners and stockholders of the mining corporation and the barge company. In this way the different interests are combined so as to cause a very large amount of the product of the Missabe Mountain and other mines to be delivered by vessels at Conneaut, but of course not all of the ore from the new range, or even all of the ore shipped by the Merritt-Colby syndicate.

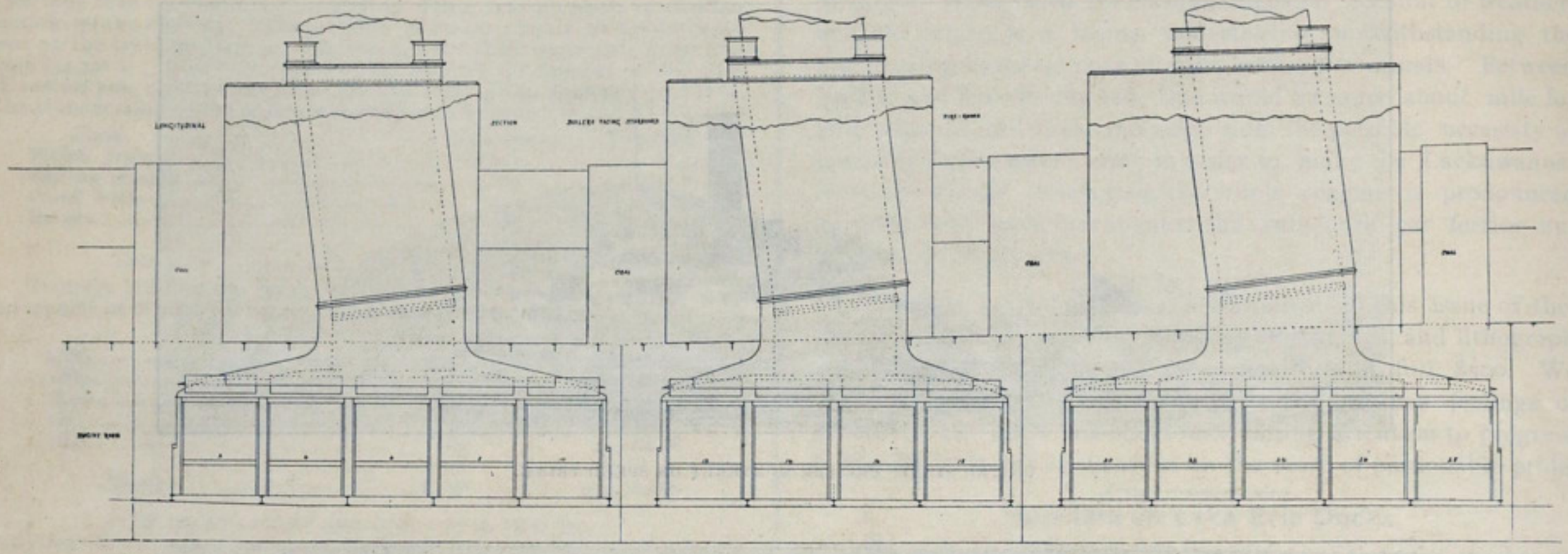
An advertisment from Gen. Poe's office, printed elsewhere in this issue, calls for bids for dredging at "collision bend," St. Mary's river. The bids will not be opened until the 10th of next month, so that the work will probably not be finished until some time in July at the earliest.

Belleville Boilers.

SOMETHING ABOUT THEIR USE IN VESSELS OF LARGE TONNAGE AND THEIR APPLICATION TO THE NEW NORTHERN LINE PASSENGER SHIPS.

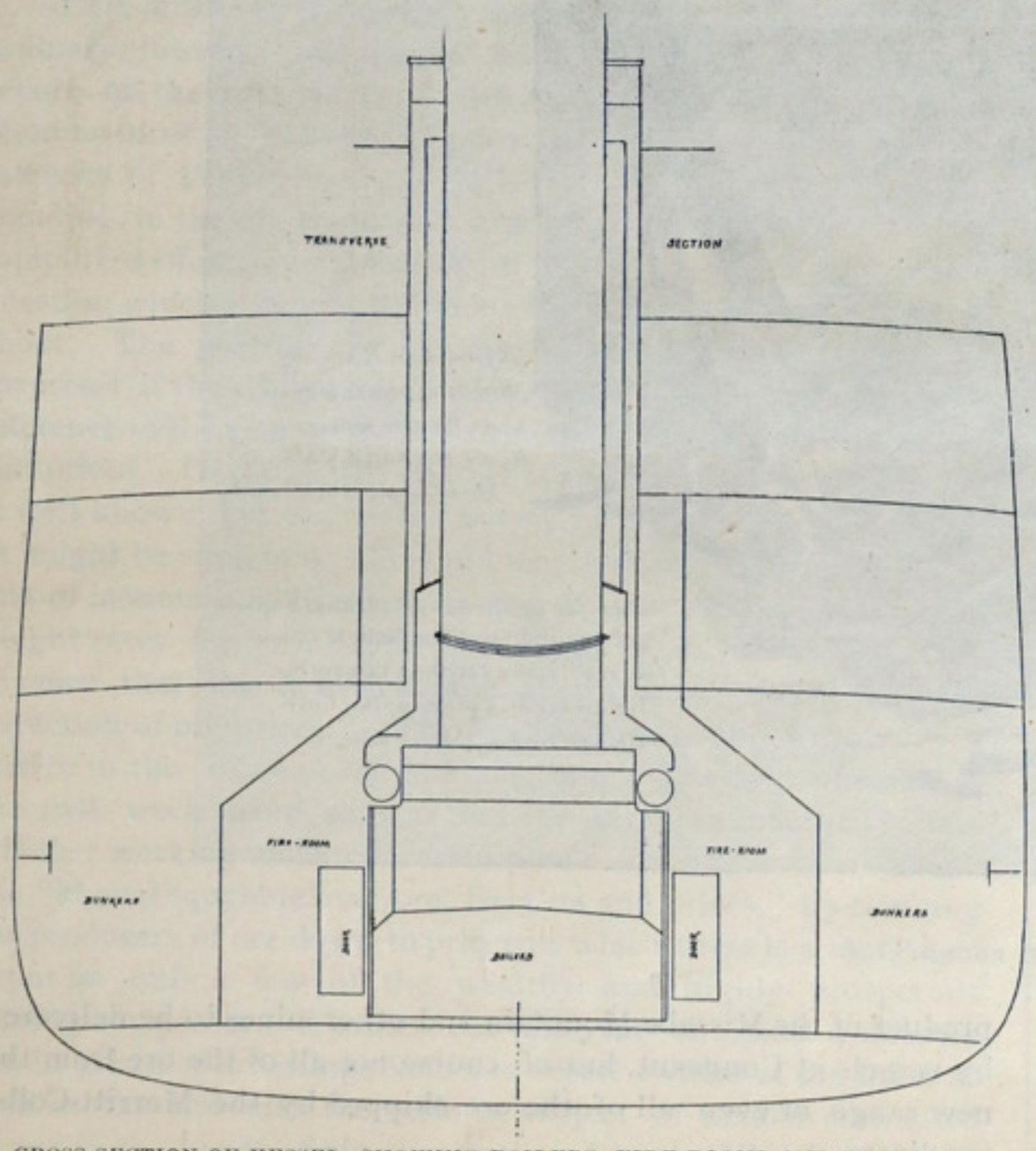
BY MIERS CORYELL.

In the illustrations on page 13 are given a front view of one generator from the fire room and one end view of two of the generators, the different groups being made up of several distinct



SECTIONAL VIEW OF HULL, SHOWING ARRANGEMENT OF BOILERS.

boilers joined together, but each complete in itself, having all of its attachments independent of the others. The illustrations on this page give an idea of the arrangement on board ship, and the relative position of the generators to each other and to the engine room. As will be seen the boilers join themselves inboard, directly over the line of the keel. They occupy the cen-



CROSS SECTION OF VESSEL, SHOWING BOILERS, FIRE ROOMS AND BUNKERS.

ter of the vessel, one-half of each group facing outward, and then come the fire rooms, one to the port and the other to the starboard side. Outside of the fire rooms are located the bunkers, and the result is an arrangement which promotes ventilation and easy coal handling, both in the stowage and in the passing of the coal. The boilers are entirely below the main deck, there being considerable of unused space between them and the deck for air circulation. The smoke pipes are seen projecting through the decks above the liberal space for air circulation.

The three groups in each of the vessels of the Northern Steamship Company comprise twenty-eight generators in all, each furnace having 29 square feet grates, and the generating elements above each furnace having 812 square feet heating surface, making totals of 812 square feet grates and 22,736 square feet heating surface, with a calculated weight of 811,000 pounds when filled with water ready for steam. The boilers will be tested for 300 pounds of steam, and the engines are of the quadruple expansion type, capable of using 250 pounds pressure. These points must be considered to arrive at the great saving of weight, in comparison with Scotch boilers, were it possible to build the latter to hold these pressures.

The indicated horse power will be 7,000 and over with moderate firing and natural draft. We have practical Belleville boiler applications to justify these assertions, as the Messageries Maritime Company's steamships Australien, Polynesien, Armand Behic and Ville de Laciotat develop more than 7,000 indicated horse power each. The Australien has been in steady service for seven years and the construction of the other vessels followed at intervals of twelve or fifteen months.

An interesting comparison may be made with the official navy trials of the French cruiser Alger, as her grate and heating surfaces are very close to ours, being 753½ square feet grates and 22,260 square feet heating surface. The official weight also agrees with ours, being 765,600 pounds, boilers and water. The power of 8,000 horses, indicated, has been reached on her trials, with the moderate consumption per square foot of grates of about 17 pounds per hour.

FROM FRENCH NAVY TRIALS FOR ACCEPTANCE OF BOILERS.

1892.	Nature of Trial.	Duration, Hours.	Speed in Knots.	Consumption per hour	
				Pounds Realized.	Per Square Foot.
March 9	At 2,000 horse power.....	6	12.7	1.454	3.86
" 18	At 5,000 horse power.....	24	17.5	1.452	9.635
May 5	At 8,000 horse power.....	12	19.21	1.586	16.838
" 10	At speed and good working	4	19.61	1.586	

The last column is added by the writer.

These generators aside from the feature of lighter weight and less space than the Scotch boilers, are particularly fitted for navy requirements. They will give 200 pounds pressure from cold water in fifteen to twenty minutes, changing a steamer from anchorage to full speed underway, and there is no extra strain in so doing. From banked fires to furnaces with full activity in eight minutes is another claim for them that can be substantiated.

The data given above from the Alger shows that the low power of 2,000 horses was economically worked with all fires in action. Less than 4 pounds were consumed per square foot of grates per hour, and each boiler carried its full pressure. The conditions were almost that of banked fires. To bring the fires in full activity would only require 8 or 10 minutes, raising the 2,000 to 8,000 horse power in that time; keeping always in mind that no damage ensues to boilers, while securing the highest possible efficency for a cruiser, namely, a quickly obtained maneuvering power and high speed. Such a cruiser would be appreciated by navy officers when acting with a fleet as a scout vessel. The English admiralty's rules to avoid damage to boilers forbid the raising of pressure from 40 to 150 pounds under an hour, a period in which a Belleville-fitted cruiser would be 20 knots away on her mission.

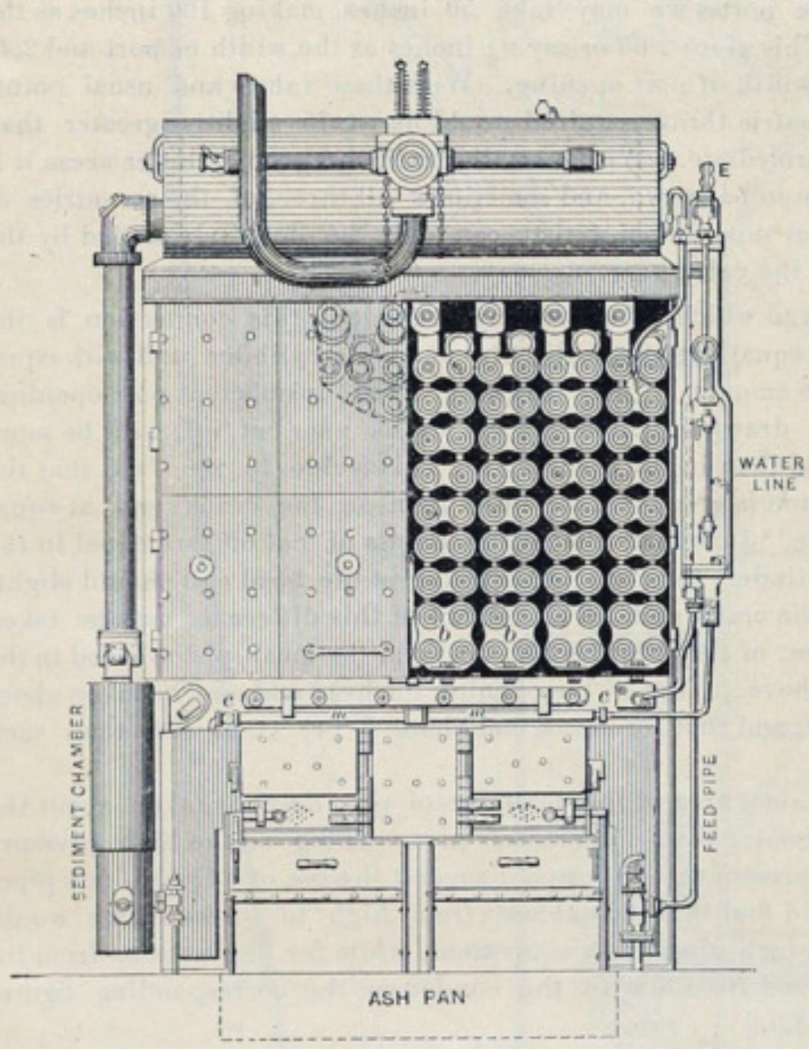
As the boilers in the vessels now under construction in Cleveland are being fitted to quadruple expansion engines, their ability to use a high steam pressure will give a better opportunity of showing the economy of their application than has ever before been presented upon a vessel of large tonnage, the only drawback heretofore being that the favorite Scotch boiler has limited the pressure and delayed expansive engines at the triple type because of its unfitness for a pressure above 160 pounds.

The writer does not consider this present application in the light of an experiment, simply because these boilers have not been used for large power in this country. In 1884 he was on board the Ortegal at Marseilles, and he has since then seen vessels using them requiring from 7,000 to 8,000 horse-power, some of them seven years in the service, and the same company is still fitting them to new and larger vessels. Nothing can be more convincing to an engineer, for instance, than to meet the Ortegal at Bordeaux on her arrival after a continuous sea voyage of twenty-two days, and contrast the condition of these boilers after such a run with what he might expect from the Scotch type of boilers under similar circumstances. As the competent and experienced engineer of the Sultana, Mr. Brown writes to a friend from his yacht at Marseilles: "To see large vessels with the Belleville boilers of 7,000 horse-power on board arrive after a long voyage, is a revelation to an engineer. The condition of their boilers warrants me in saying that they are far ahead of my old favorites, the Scotch boilers, for sea service."

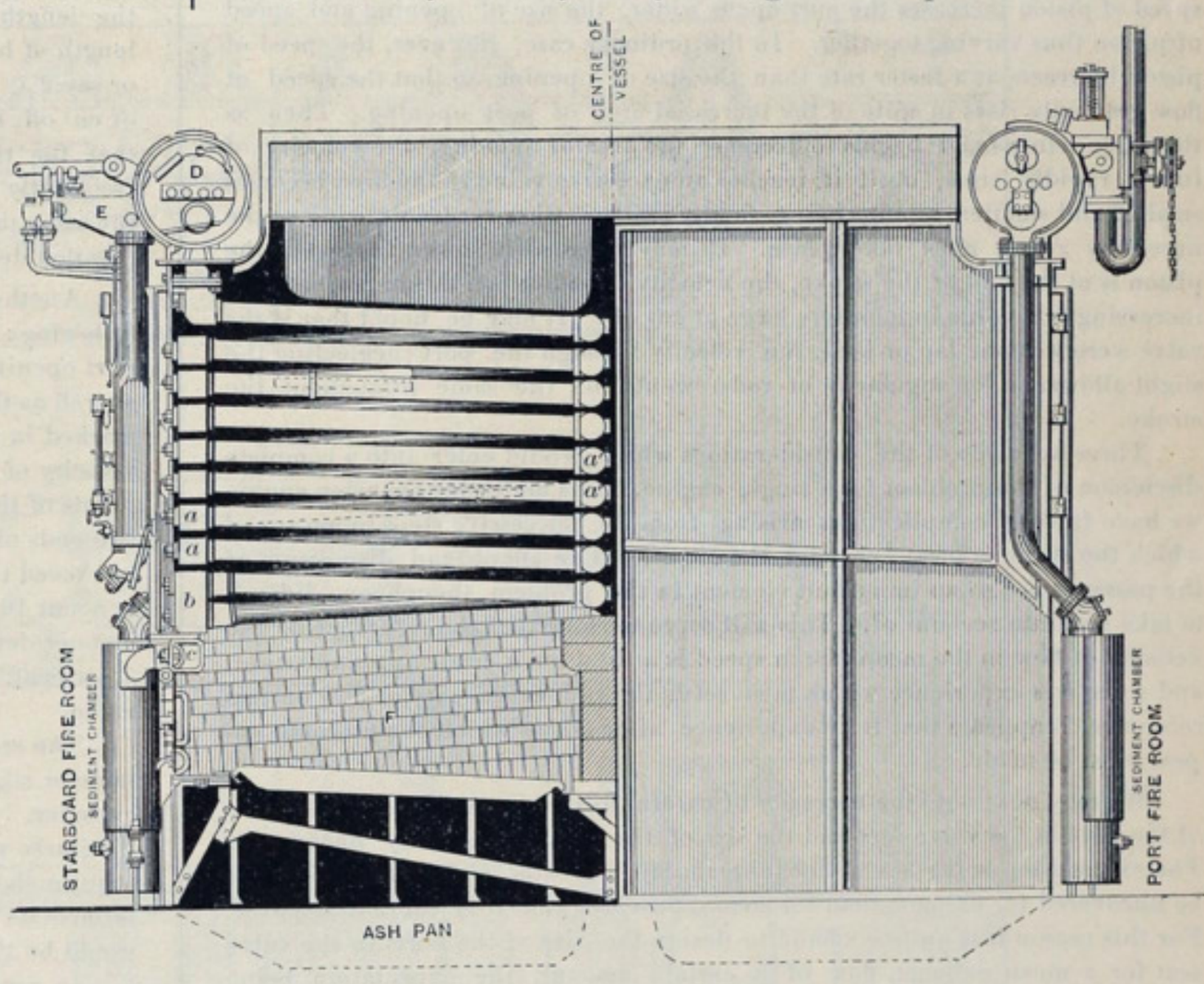
To make a comparison of these boilers with any other tubulous type of boiler and by this make unfavorable criticisms because the American boilers are found defective, is not to arrive at the real facts of the case. It is not so much the fault of these tubulous boilers. as it is the curious combination of their installation. In answer also to the "knock out" question often made, "Why don't the English use them?", I can say that after a thorough investigation and favorable reports from competent engineers high in their profession, they are getting them as fast as Belleville can make them at this present time.

In connection with the construction of these generators, there are the Belleville attachments of feed water regulator, steam separator and purifier, sediment collector, regulating pressure valve and an improved pump for feeding, all of which are marvels of simplicity in mechanical details and of great durability.

I hope that during the season of the Worlds Columbian Exposition some of the yachts fitted up with these boilers will cruise upon the lakes and visit the large cities. I have invariably found that owners, captains and engineers who are shipmates with the Belleville boilers are enthusiastic in speaking of them. They are appreciated when used, especially by the engineers, who find that they are very easily managed and kept in order.



FRONT VIEW OF ONE GENERATOR FROM FIRE ROOM



SECTION THROUGH CENTRE OF ONE GENERATOR

½ END VIEW OF A GROUP

A Familiar Comparison.

From all quarters now comes the question: "Will the size of the Great Eastern soon be equalled in a successful passenger steamer?" The arrival of the Campania in New York is the latest excuse for this query, but the repeated comparisons are not without interest. It is admitted that the huge blunder made in the Great Eastern was due to the vessel being constructed prematurely, as her dimensions are now approached more nearly each year. She was 680 feet long and the Campania is 620. It is true that during late years length has been developed much more than other dimensions, for the Campania has but 65 feet and 3 inches extreme beam, against the Great Eastern's 83 feet, and 43 feet in depth, against 58 of the Great Eastern, though the difference is mainly due to the greater freeboard of the latter, the draught of water being about the same. In displacement the new vessel is about two thirds the size of the old. In power and speed there is, of course, no comparison, for each of the two sets of engines of the Campania is expected to develop something like 15,000 horse power, while the collective horse power of the Great Eastern's engines was but 10,000. Another generation will see the Great Eastern surpassed.

Marine Engine Design—Size of Steam Ports and Passages.

(*Continued from Vol. 7, No. 13.*)

The controlling element in the design of ports, pipes and passages is usually taken as the mean velocity of flow, such velocity being reckoned from the mean piston speed. The subject is, however, by no means as simple as might at first sight appear. Without proposing any extended development of the problem, a statement of the principal elements entering into it may not be without interest.

Consider the steam in the main pipe near the high pressure valve chest. The valve opens and admits steam with a rush until the pressure in the chest and cylinder becomes equal to that in the pipe. Then as the piston stops for an instant near the end of the stroke, the inflow is more or less suddenly checked. The inflow begins slowly again as the piston begins the next stroke. The latter moves faster and faster until near mid stroke, when its velocity is about one and one-half times its mean value. The velocity of inflow of the steam correspondingly increases up to about mid-stroke when cut-off occurs, and the flow through the pipe ceases until steam is opened to the other end. The steam in the pipe is thus subjected to a series of periodic stops and starts, and moves with a velocity from nothihg to about one and one-half times that due to the mean piston speed.

With the flow through a port, the problem is further complicated by the continually varying size of the opening. When the opening is small, the piston is near the end of the stroke and its velocity is low, and therefore the necessary amount of steam can enter without undue speed of flow. As the speed of piston increases the port opens wider, the size of opening and speed of piston thus varying together. In the ordinary case, however, the speed of piston increases at a faster rate than the size of opening, so that the speed of flow gradually rises in spite of the increased area of port opening. Then as the valve returns and begins to decrease the area of opening, the velocity of inflow rapidly rises, until it reaches an excessive value as the area becomes smaller and smaller, a point being finally reached where wire-drawing as the necessary result must take place. It may be readily shown that when the piston is at the end of the stroke, the velocity of inflow is a minimum, steadily increasing to a value indefinitely large at cut off. It may be noted that if the valve were without lap or lead, the velocity through the port (neglecting the slight allowance for angularity of rods) would be the same throughout the stroke.

These are some of the considerations which would enter into a complete discussion of the problem for a single engine. In a multiple expansion engine we have further complications arising from the successive steps by means of which the steam is passed through the engine. The shape and disposition of the passages is also an important element in the problem, though one difficult to take accurate account of. This will serve to show that the reference of the velocity of flow to the mean piston speed is at best but a crude approximation, and since it is experience which must settle the proper velocity of flow on this reference, it appears that it is experience after all to which the ultimate appeal must be made.

We may next note the necessity of careful discrimination between the size of the port in the valve seat and the size of the opening actually uncovered. The exhaust lap being less than the steam lap, a greater width of opening can be uncovered for exhaust than for steam, provided that it is there to uncover. For this reason it is quite common to design the size of the ports in the valve seat for a mean exhaust flow of a certain amount, the expectation being that for exhaust they will be wholly uncovered and therefore wholly utilized, while on the steam side they will be only partially uncovered, the mean velocity of inflow being proportionately higher. The exhaust velocity in the high and intermediate pressure cylinders may be taken from 5,000 to 6,000 feet per minute. In the low pressure cylinder it is usually neccssary or at least desirable from structural considerations to provide a somewhat smaller port than such a velocity would give, and for which the velocity may be taken at from 6,500 to 7,500 feet per minute. For the entering steam the velocity may be taken at from 6,000 to 8,000 feet per minute. The lower velocities are always desirable and should be adopted in a design unless conflicting considerations exist which may justify the adoption of the higher values. Extreme velocities always result in general wire drawing and loss of power.

Taking for illustration the dimensions derived in a previous number (see Vol. 6, No. 23) we have as follows: Cylinders 20½, 33½ and 54 inches by 42 inches stroke; revolutions 100. The mean piston speed is then 700 feet per minute. Taking 5,000 as the desirable speed of exhaust, we have for the high pressure cylinder the proportion as follows:

Area of exhaust opening : area of piston :: velocity of piston : velocity of steam. Or $a : 330 :: 700 : 5000$.

Whence $a = \frac{700 \times 330}{5000} = 46.02$ square inches.

This may be taken as the area of the opening in the valve seat. Next to find the width of opening we proceed as follows: This area, as is well known, is more or less taken up by the bridging necessary to carry the valve packing rings across the port. This will take out about one-fifth of the area which would be otherwise available, so that the area 46.02 may be taken as four-fifths of the total amount, including bridges. This gives as such total area $46.02 \div \frac{4}{5} = 57.5$. This area is equal to the circumference of the valve multiplied by the width. Experience has shown that fair proportions are usually obtained on the high pressure cylinder with a valve whose diameter is about one-half that of the cylinder. In the present case the diameter may be taken as 10 inches, or with a circumference of 31.416. This gives 1.83 or say $1\frac{13}{16}$ inches as the width of the port itself. For the width of steam opening we may take the width of port reduced in the ratio of the permissible velocity of the entering steam to that of the exhaust. Taking the former at 6,500 we should have width of steam opening equal to $\frac{50 \times 1.83}{65} = 1.405$, or say $1\frac{7}{16}$.

In the intermediate cylinder it will be desirable to make use of two of the same sized valves. Using as we may permissably a slightly higher value of the velocity of inflow and exhaust, we may take 7,000 for the former and 5,500 for the latter. The two areas necessary, found in the same way as above, will then result 140 and 110. Dividing by twice the circumference 62.83, we have for the width of port 2.23, or say $2\frac{1}{4}$, and for the width of port opening 1.75, or $1\frac{3}{4}$. With the angle of advance necessary for the points of cut off desired, this will probably require an eccentric of slightly greater throw than that for the high.

In the low pressure we may assume a double ported slide valve, and a still higher velocity will be necessary and admissable in order to keep down the size of the valve gear. Assuming for inflow and exhaust velocities of 8,000 and 7,500 feet respectively, we find the two areas to result 246 and 263. For the length of the ports we may take 50 inches, making 100 inches as the length of both. This gives 2.63 or say $2\frac{5}{8}$ inches as the width of port and 2.46 or say $2\frac{7}{16}$ as the width of port opening. With these values and usual points of cut off, the eccentric throw required would be again slightly greater than that for the intermediate. With a smaller ratio between cylinder areas it is frequently possible to have two, and sometimes all three, of the eccentrics of the same throw, but this is a point that can only be definitely settled by the detailed design of the valve gear.

Another point to which reference may be made in this connection is the following: With equal cut offs in the two ends of a cylinder and with equal port openings, the amount of wire drawing due to insufficient port opening, as well as the wire drawing which always exists near cut off, will be more marked in the head than in the crank end. This is due to the fact that the velocity of the piston is greater in the head than in the crank end at equal points of the stroke. It follows that if the points of cut off are equal in the two ends of the cylinder, then the port opening in the head end should slightly exceed that in the crank end. The amount of this difference may be taken at about 10 per cent. of the value as derived from the mean piston speed in the manner detailed above. That is, the opening for head end may be taken about 5 per cent. greater, and that for crank end about 5 per cent. less than such value.

The cross sectional area of the main steam pipe may be taken about the same or slightly greater than the area of port opening on the high pressure cylinder. In the present case this would suggest the use of a 7½ or 8-inch pipe. Similarly we should find that the exhaust from high to intermediate would require about a 12-inch pipe, or its equivalent, while for the exhaust from intermediate to low and from low to the condenser the corresponding figures would be 17 and 18.5.

In general it should be remembered that while it is desirable to have the valve gear as small and light as possible, yet it is very poor economy to sacrifice to this consideration the proper size of ports and passages. In not a few cases which have fallen under the writer's notice a more liberal allowance in this respect would have paid for itself many times over in increased power developed.

*Written for the MARINE REVIEW by W. F. Durand, principal of Graduate School of Marine Engineering and Naval Architecture, Sibley College, Cornell University.

Depths of Water at Lake Michigan Ports.

Recent soundings taken under the direction of Major James F. Gregory, corps of engineers, U. S. A. officer in charge, show the governing depths of water in the entrance channels to be as follows:

	Feet.
Kenosha, Wis.	13.0
*Racine, Wis.	13.4
Port Washington, Wis.	10.5
Sheboygan, Wis.	16.0
Manitowoc, Wis.	14.7
Two Rivers, Wis.	10.0
Kewaunee, Wis.	13.0
Sturgeon Bay Harbor, Wis.	14.3
Sturgeon Bay Canal, Wis.	13.0
Menominee Mich. and Wis.	16.0

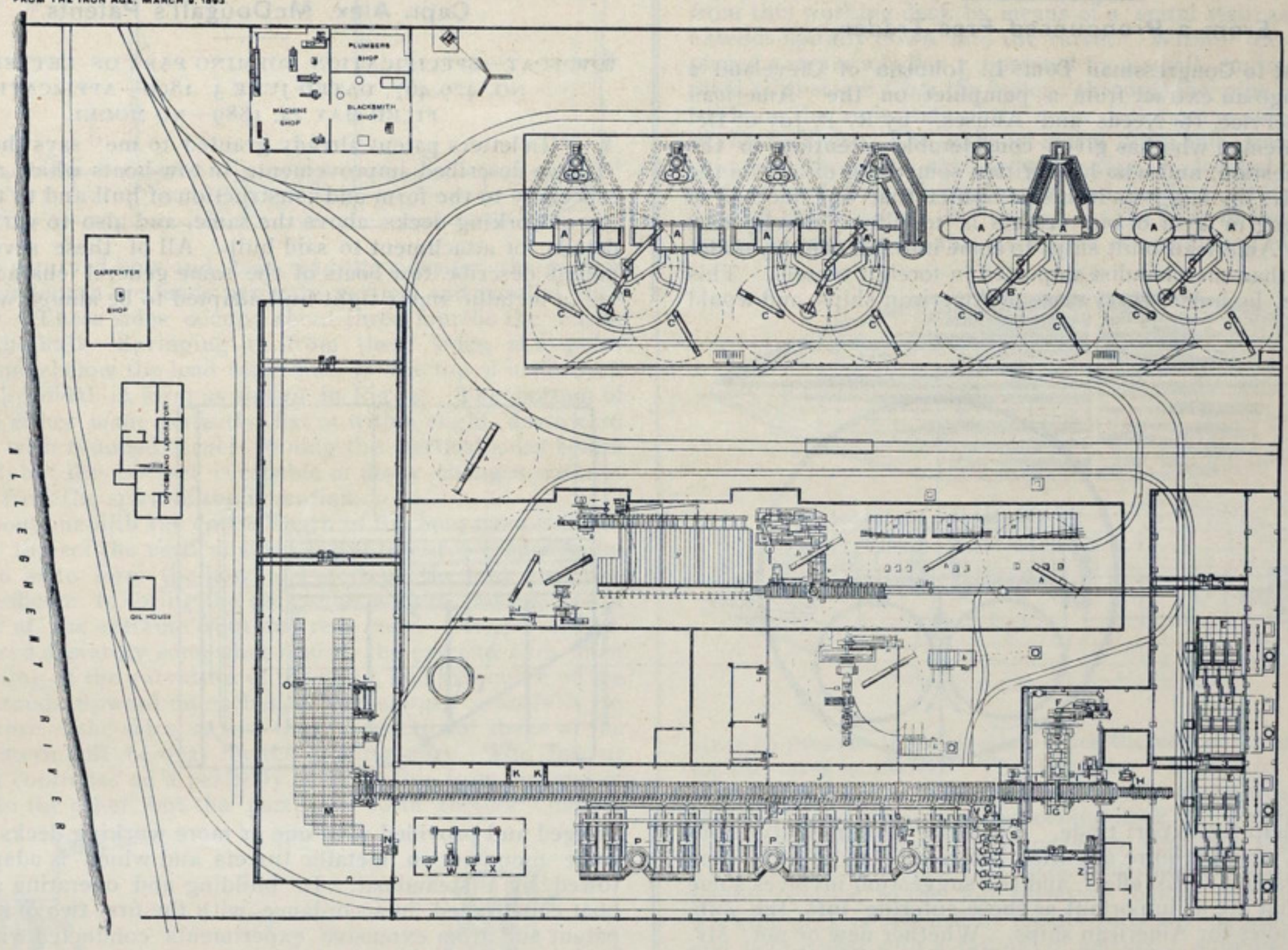
*At Racine the formation of a channel 80 feet wide and 16 feet deep is in progress.

Mr. E. Platt Stratton, chief surveyor for the American Shipmasters' Association, was in Cleveland last week. The sixth vessel built by F. W. Wheeler & Co. of West Bay City under the inspection of this association will be launched in a few days.

A Steel Plant Fitted for Ship Material.

Some of the largest contracts awarded recently for material entering into the construction of naval vessels of the United States have been secured by the Carbon Steel Company of Pittsburg, Pa. Contracts with builders of merchant vessels on the lakes and on the coast have also been of an extensive nature. The works illustrated on this page are new and consist mainly of one 36-inch universal mill, one 48-inch sheet mill and one new three high 124-inch plate mill. They encircle the company's former plant and have been built up within a year at a cost of $500,000. There is a 34-inch three high plate mill, G, with rolls 124 inches long. This mill is driven by a 46 x 48 automatic piston valve engine, F, with a 26 foot 40 ton fly wheel, and it is probably the first mill of the character built in this country driven by an automatic engine.

The plan shows the works as grouped on four sides of a square. The open hearth plant A consists of two 15 and six 30-ton furnaces. The furnaces are all of the "Lash" type, having the regenerators in the flue leading to the stack. Four soaking pit furnaces, E, are provided for the plate and universal mill, *e*,



WORKS OF THE CARBON STEEL COMPANY, PITTSBURG, PA.

each with three holes. In addition to these furnaces there are four large heating furnaces, *a*, used exclusively for blooms and slabs. The covers of the soaking-pit furnaces are removed by hydraulic cylinders, and disk valves 30 inches in diameter are used entirely for reversing, there being four chimney, two gas and two air valves. The valves are operated by small hydraulic cylinders. Spanning the furnaces are two high speed electric traveling cranes, each of 10 tons capacity, 47 feet 3 inches span. Covering the plate mill train proper is a 25-ton electric traveling crane, 2,of 37 feet 3 inches span, which is used for changing rolls and repair work generally; this same crane spans a large roll lathe, Z. In the shear building or shipping department two more cranes are placed, each of 5 tons capacity and 68 feet 3 inches span, which are used for loading purposes, not only for the plate mill proper, but for the universal and sheet mills C. The cooling tables are 375 feet long from the center of the mill to the blade of the shear, the rollers being 13 inches in diameter and 6 feet long, and spaced 2 feet 7 inches between centers.

The entire plant is driven by 24 two-flue boilers, each 54 inches diameter by 30 feet long, with two 18-inch flues, and the electrical department is driven by two horse power dynamos, W, driven by a 150 horse-power Ball engine, X. The main shear L is one of the Morgan Engineering Company's heaviest build, having 136-inch blade, capable of cutting 2½ inches. A duplicate of the shear is now being erected, which weighs 185 tons.

In the open-hearth department it was a matter of necessity that the general arrangement, which was fixed by the four old furnaces, be carried out in addition to the four new ones, and outside of the method of working the valves, which is done entirely by hydraulic power, and in the arrangement of the ladle crane, no special novelties are introduced. The plate mill proper has three-high rolls 34 x 124, middle roll 20 x 124, with lifting tables on both sides having a capacity of 10 tons each. The pinions are of steel and each roll housing weighs 26 tons.

The dimensions of the various buildings are as follows: Open hearth, 384 x 116 feet; heating furnace, 222 x 64 feet; building over plate mill, 118 x 40 feet; building over boilers and cooling table, 325 x 78 feet; shear building, 300 x 71 feet; universal mill building, 318 x 80 feet; sheet mill building, 200 x 60 feet.

Some additional improvements are now being made in these works, and when completed the Carbon company expects to turn out 350 tons of open hearth steel every twenty-four hours, their present capacity for that period being abont 225 tons. The description of the plant is taken from the Iron Age of New York.

The two new Cunard ships, the Campania and Lucania, are fitted up with metallic berths, and the question is, why not? One hardly ever sees a bedstead of wood in England, and the wonder is that the same practice has not been sooner carried out in ships. These metal berths are exceedingly fine in appearance, with bottoms of woven wire and ornamental panels in front. The various members of the framing are cylindrical, so there are no corners, and the whole seems to fit in and harmonize with the ship itself. The principal berths are so arranged that when the mattresses are raised the front rail shuts down beneath, so the lower berth is at once converted to a sofa, or in smooth weather the "rail" can be dispensed with in the upper berths also, if the passenger prefers. —Industries, San Francisco.

Device for Circulating Water in Marine Boilers.

An engraving on this page represeents the Keiller patent circulator as applied to marine boilers, showing the mode of placing the apparatus, which is simply a small propeller wheel attached to a shaft running through a stuffing box and pipe down to the bottom of the boiler and turned with a crank on the outside to set the water in motion. F. W. Wheeler & Co., West Bay City, Mich., control the United States patent on this device, the object of which, as will be understood, is to have the temperature of the water in the bottom of the boiler the same as in the top. The apparatus was placed in the boilers of four light-ships constructed last year by F. W. Wheeler & Co. for the United States light-house service, and tests of it were made by Walfred T. Sylven, superintending engineer of the service. The temperature of the water in the bottom of the boiler was taken every five minutes from the time of firing up until 5 pounds of steam had been obtained. At 8 a. m. the temperature was 8 degrees, which increased about 3 degrees every five minutes until 10:35 a. m., when the temperature registered 212 degrees with 5 pounds of steam.

From a Pronounced Free Trader.

We sent to Congressman Tom L. Johnson of Cleveland a short time ago an extract from a pamphlet on the "American Merchant Service, Its Needs and Abuses," by R. P. Joy of Detroit, a gentleman who has given considerable attention to the shipping question, and who has written something of late on the subject. Mr. Joy suggests in his pamphlet that one method of discriminating in favor of our vessels is to allow merchandise imported in American built ships to come into this country under a less duty than merchandise imported in foreign vessels. This would cover, he holds, every class of American ships, and would indirectly help the export trade. There are certain treaty stipulations that would require attention before a policy of this kind could be carried into effect, and the suggestion involves some questions that are as important as those entering into the subject of subsidies for American ships. Whether new or not, Mr. Joy's policy is suggestive of a modification of the question of subsidies, and his pamphlet was thought interesting enough to warrant a reply from any of the pronounced advocates of free or subsidized ships in Congress. It was sent to Mr. Johnson on account of the many open declarations which he has made in favor of free trade of all kinds. His answer, which follows, is not favorable to the proposed plan:

EDITOR MARINE REVIEW:

I have read the article to which you call my attention. I agree with you that we ought to have a merchant marine and it is vastly more important than a navy. In fact, to have our own ships and to become the carrier, not only of our merchandise, but to reach out and even do more than this, is a blessing and an advance in the right direction, while a navy is even by its friends admitted to be only a necessary evil and one that if the civilization of the world had progressed far enough would be done away with. I believe that time has now arrived and that a navy today is a useless expenditure of money. The question arises how best to build up and encourage American ships. Should it be by more restrictions, when we have found that our difficulty in the past has been too much restriction? Would it not be better to go in the other direction and try what the removal of the restrictions would accomplish? Free ships and the removal of duties on all materials going into the construction of ships would do more, in my judgment, to encourage our merchant marine than bounties, subsidies or a ten per cent. reduction on goods imported in American vessels. The office of government, to my mind, is to keep open the highways, remove the barriers, light and protect the dangerous places. Police the ocean if you will and allow the laws of trade to do the rest. We were the ship builders of the world before the introduction of iron vessels. Our material was then on the free list. We would be the ship builders and the ocean carriers of the world to-day if we allowed natural conditions to prevail instead of artificial restriction and hindrances that build up a little, it is true, but tear down and destroy much more. Trade, like the circulation of the blood, should be free, and where a man has many bandages producing bad health, instead of putting on more, it would seem wiser for him to try the effect of removing those he has.

House of Representatives,
Washington, D. C.,
May 1, 1893.

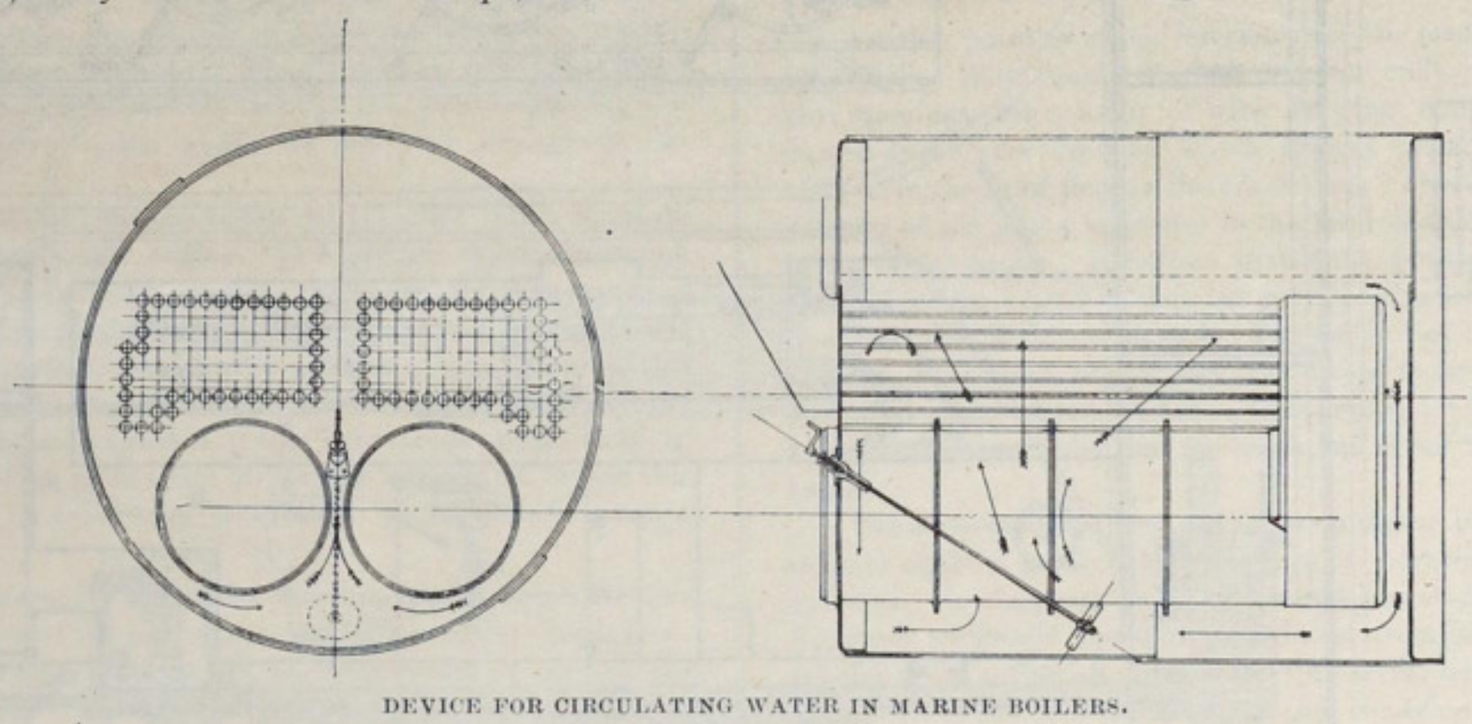
Tom L. Johnson

Capt. Alex. McDougall's Patents.*

TOW BOAT—SPECIFICATION FORMING PART OF LETTERS PATENT NO. 429,467, DATED JUNE 3, 1890—APPLICATION FILED MAY 24, 1889—NO MODEL.

"In letters patent already granted to me" says the inventor, "I have described improvements in tow-boats which relate more especially to the form and construction of hull and to the mounting of working-decks above the same, and also to various minor details for attachment to said hull. All of these several letters patent describe tow-boats of the same general characteristics—viz., a metallic water-tight hull adapted to be almost wholly submerged and provided with one or more working-decks above the same mounted on metallic turrets and which is adapted to be towed by a steamboat. In building and operating a practical boat constructed in accordance with the first two of said letters patent and from extensive experiments conducted with models built to accord with the description of the last letters patent I have arrived at the conclusion that the forms of hull described in said letters patent are capable of many advantageous changes. Before building a practical boat it was thought that the upper portion thereof should be made with as great a curvature as possible—viz., semicircular—in order that the effect of the waves on the same would be reduced to a minimum; but I have found that the great curvature of the top of the boat is disadvantageous for the reason that in very large boats, if built in the same proportions, the deck will be brought much above the customary loading-chutes now generally in use for handling grain, coal, etc., and also that there is danger in some instances of vessels riding up on the portions of said top which is submerged and injuring the same. This objection is in a measure avoided by the construction illustrated and described in the last letters patent granted me, No. 393,997, in which a hull is shown square in cross-section and with rounded corners.

The tow-boat forming the subject-matter of this present application is intended to overcome all the objections to the former tow-boats, which I propose to accomplish by making the main portion of the hull with straight sides, rounded at the bottoms



DEVICE FOR CIRCULATING WATER IN MARINE BOILERS.

*Under this heading we will publish specifications accompanying letters patent granted to Alexander McDougall since his first application for a patent on the whale-back type of vessel in March, 1880.

thereof, and with an ellipsoidal top. thereby securing a very strong and immovable construction, and also by making use of a bow and stern each oval in cross-section for its greater part. Figure 1 in the accompanying drawings is a cross-section of the body portion of the hull; Fig. 2, an elevation of the entire boat; Fig. 3, a longitudinal sectional view of the same; Fig. 4, a top view of the boat, and Fig. 5 a bottom view of the same. The preferable dimensions of the hull are 260 feet in length, 36 feet in width, and 22 feet in depth; but it will be of course understood that these dimensions may be changed without departing from the spirit of my invention. The hull for the tow-boat is

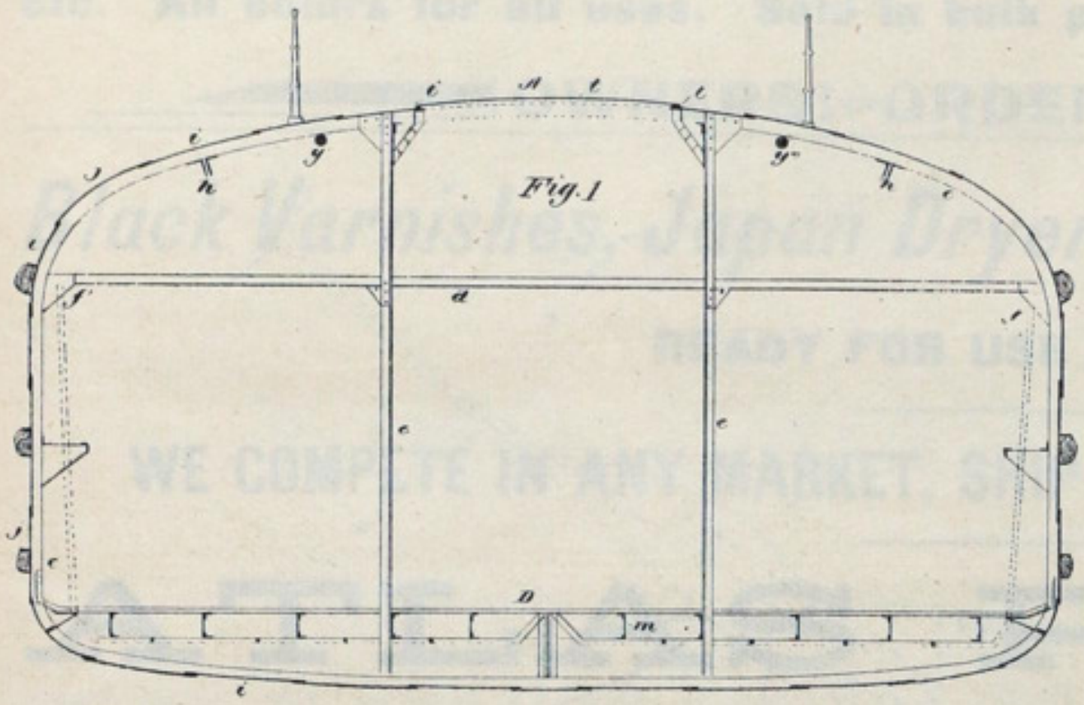


Fig. 1

made with a curved bow and stern, and the sides for the greater part of their length are made perfectly vertical and parallel with each other. These sides occupy about three fourths the entire depth of the hull. Springing in from these sides, at a point some distance below the load water-line, is the top of main deck A, made elipsoidal in form as shown in Fig. 1. The bottom of the hull is either made perfectly flat or with a slight downward curve and with rounded corners joining the vertical sides before mentioned, but this bottom is capable of many changes without departing from the spirit of the invention.

At about one-fifth the entire length of the boat from each extreme end thereof the vertical sides begin to curve gradually inwardly, so as to form the bow and stern of the hull, and this curve is sufficient to bring the two sides within about 5 feet of each other at the extreme front and rear ends. The bottom begins to curvd upwardly somewhat nearer the extreme ends than the beginning of the curvature of the sides, and this curve of the bottom extends upward on each side and merges gracefully in the curvature of the sides, so that the cross-sectional shape of the bow and stern will be oval for the greater part. The top or main deck continues on a perfectly straight line from one end of the hull to the other, but the particular form thereof changes

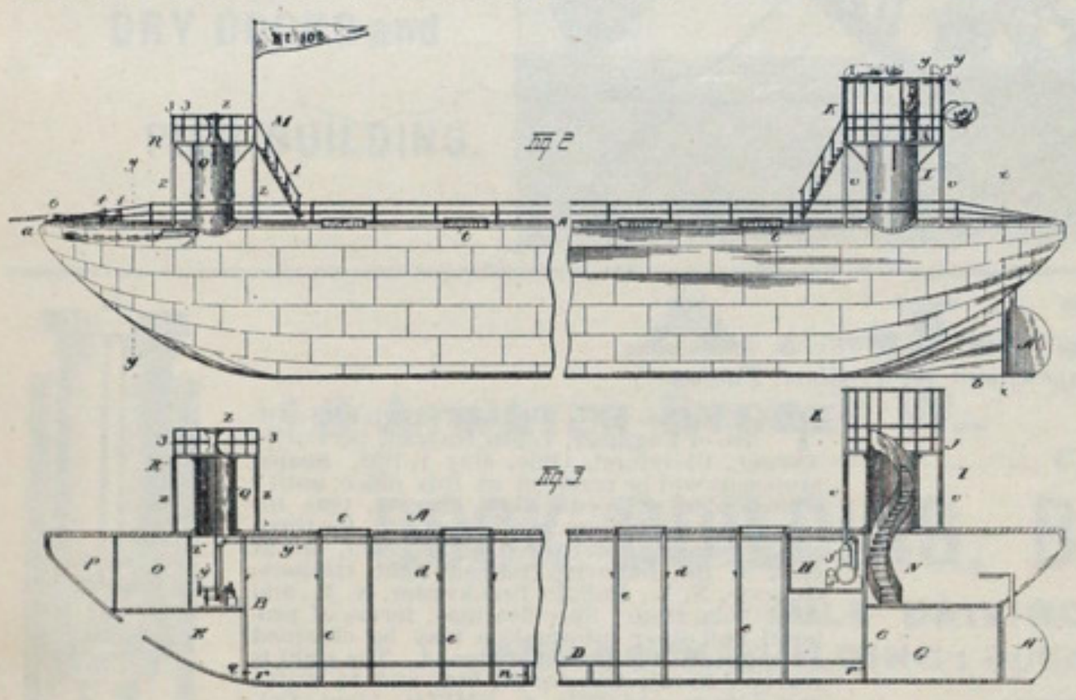


Fig. 2

Fig. 3

gradually with the curve of the sides until the elipsoidal shape of the top is changed by degrees into a perfect semicircle at a point adjacent to the extreme ends. The extreme front and rear of the boat are formed of a perfectly flat circular surface, which is preferably protected by an elastic buffer *a*. The use of these buffers is old and I make no claim thereto. Both the bow and stern are precisely alike, with the single exception that a skeg is formed on the stern, and they are of a spoon shape, as I have just described. The stern is provided with a skeg *b*, which is continuous with the plating of the hull and begins at a point on the bottom of the boat near the upward curve of the bottom to form the stern. This skeg continues in line with the center line of the bottom of the boat to a point adjacent to the extreme end. By means of this skeg, I can use a large rudder A, and the boat will therefore steer much better than if the skeg were not used.

"The foregoing description relating to the outside form of hull forms the principal subject-matter of my invention, and to which I attach the greatest importance. A small engine-room H is located, preferably, at the upper portion of the hull just forward of the after bulk-head, and contains a boiler *s* or a steam-pump *s'*, by which the water may be pumped out of the tanks and air-chamber as described. Entrance to the hull is effected by means of a number of hatchways, each of which is covered by a hatch *t* during transportation. The present boat is provided with a rear turret I at the stern portion which supports a working-deck J. To protect the steersman on this working-deck, a housing K of some kind is used. A capstan L is placed upon this rear working-deck, and it is used for handling the aft hawser. A steering-wheel M is also mounted on this rear working-deck and connects with the rudder A. The cabin is reached from this working-deck by means of a spiral staircase N, which extends spirally down into the turret. Within the forecastle is placed a steam windlas *y*, operated by a small engine, and supplied with steam from the boiler *s* through the pipe *y'*, which extends on the under side of the main deck on one side of the line of the hatches. The exhaust-steam from this small engine is conveyed through a corresponding pipe *y''*, located on the other side of said line of hatchways and leading into the smoke-pipe of the boiler *s*. By this means the heat of these conducting-pipes which keep the main deck at a sufficient high temper-

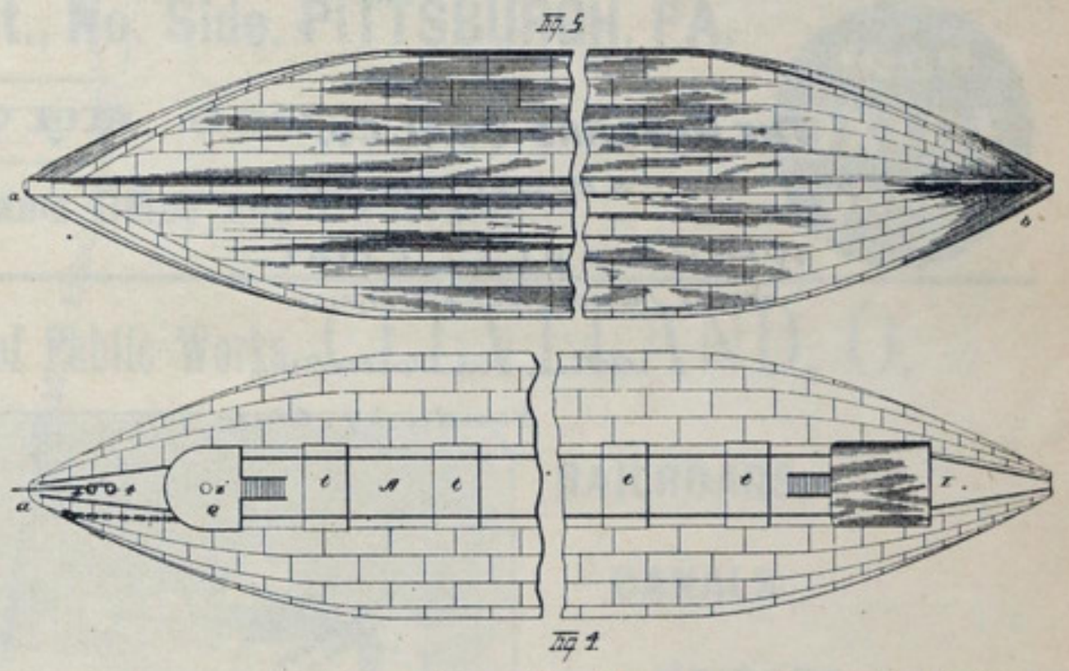


Fig. 5

Fig. 4

ature to prevent the formation of ice thereon and a safer footing for the crew is offered. The windlass *y* is used to handle the anchor-chains and fore hawser. Directly above this windlass *i* the fore turret R supports a working-deck R', which is directly adjacent to the pipe *z z*, arranged to ventilate the forecastle. This fore working-deck also carries the capstan *z'*, which is preferably coupled to the fore turret, as before referred to. The working-deck is reached by means of heavy metallic ladders 1 1 and is provided with a railing of netting 2, supported on stanchions 3 3 for the protection of the crew. The towing-hawser is attached either to timber-heads 4 4 on the working deck R or to timber-heads 5 5, placed on the main deck, and this hawser extends through an eye 6 at the extreme forward portion of the boat, so as to leave the boat in the exact form.

"What I claim as new and desire to secure by letters patent is: First—The hull for a tow-boat, having a curved bow, with a top ellipsoidal in form for a greater part of its length, with straight sides, and with a bottom rounded at the corners, substantially as set forth. Second—The hull for a tow-boat, having a top elipsoidal in form for the length of the main portion of the hull, a bow oval in cross-section for its greater part and circular in cross-section at its extreme end, a similarly constructed stern provided with a skeg, parallel sides for the length of the main portion of the hull, and a bottom rounded at the corners. Third—In a tow-boat, a boiler located near its stern, a steam-windlas near its bow, a line of steam-conducting pipes extending from said boiler to the windlass on one side of the hatchways adjacent to the deck, and a return line of exhaust steam conducting pipes extending from said windlass to the said boiler and on the other side of the hatchways adjacent to the deck, so that said deck will be heated from said lines of conducting-pipes, for the purposes mentioned,"

Oil Used on the Detroit and Alabama.

The recent tests of the Detroit and the Alabama developed points of interest and value to owners of lake boats. In the test of the Detroit a speed was shown in excess of that required in the specifications, that secured for the builders a bonus of $171,000 over the contract price. This cruiser is equipped with two triple-expansion engines of 6,000 indicated horse power, and developed 780 feet piston speed per minute. On the preliminary and official tests Vacuum marine engine oil was used exclusively, instead of sperm or lard oils, which have heretofore been mostly used in making trial tests. The result was very closely watched, and the builders state that the oil service was at all times sufficient, and at no time was there any necessity for supplementing with hand oiling. The builders of the Alabama make a similar report. On that boat the Vacuum marine engine oil was fed to the crank pins by wicks of eight strands of zephyr, which gave ample lubrication without hand oiling. The Alabama is equipped with a triple expansion (four cylinder) engine of 2,200 horse power, and developed a speed of 707 piston feet per minute. After a careful inspection of the crank pins, journals and cylinders, the builders of both the above boats write that they consider Vacuum marine engine oil equal in all respects as a lubricant to the best quality of sperm, lard or olive oils. In both of the above tests the Vacuum 600 W cylinder oil was also used. These oils are made only by the Vacuum Oil Company of Rochester, N. Y., and are kept in stock at the leading ports.

OFFICE OF LIGHT-HOUSE ENGINEER, Fifth District, Baltimore, Md., April 7, 1893. Sealed proposals will be received at this office until 2 o'clock p.m. of Wednesday, the 17th day of May, 1893 for furnishing the materials and labor of all kinds necessary for the completion, delivery, and erection at the sites of the metal work of Cape Charles and Hog Island Light Towers, Virginia, for a fixed sum for each light tower or for an aggregate sum for both towers. The bids most advantageous to the United States Government will be accepted. Plans, specifications, forms of proposal, and other information may be obtained on application to this office. The right is reserved to reject any and all bids and to waive any defects. ERIC BERGLAND, Captain of Engineers, U. S. A., Light-House Engineer Fifth District. 13 to 12

TO ENGINE AND BOILER MAKERS—Office of Engineer, Tenth District, 185 Euclid Avenue, Cleveland, Ohio, May 1, 1893. Sealed proposals will be received at this office until 2 o'clock p. m. of Wednesday, May 17, 1893, for furnishing the boilers, machinery, etc., for three steam fog signals delivered and erected, one at each of the following named light stations: Genesee, N. Y., Buffalo Breakwater, N. Y., and Ashtabula, Ohio. Specifications, forms of proposal, and other information may be obtained on application to the undersigned. The right is reserved to reject any or all bids and to waive any defects. JARED A. SMITH, Lieut. Col. Corps of Engineers, U. S. A., Engineer, Tenth Light-House District.

U. S. ENGINEER OFFICE, 34 West Congress Street, Detroit, Mich. May 11, 1893. Sealed proposals for dredging at "the elbow" in Lake Grorge, Saint Mary's River, Michigan, will be received at this office until 2 p. m., June 10, 1893, and then will be publicly opened. Specifications, blank forms, and all available information will be furnished on application to this office. O. M. POE, Colonel, Corps of Engineers, &c. 11-18-25-1

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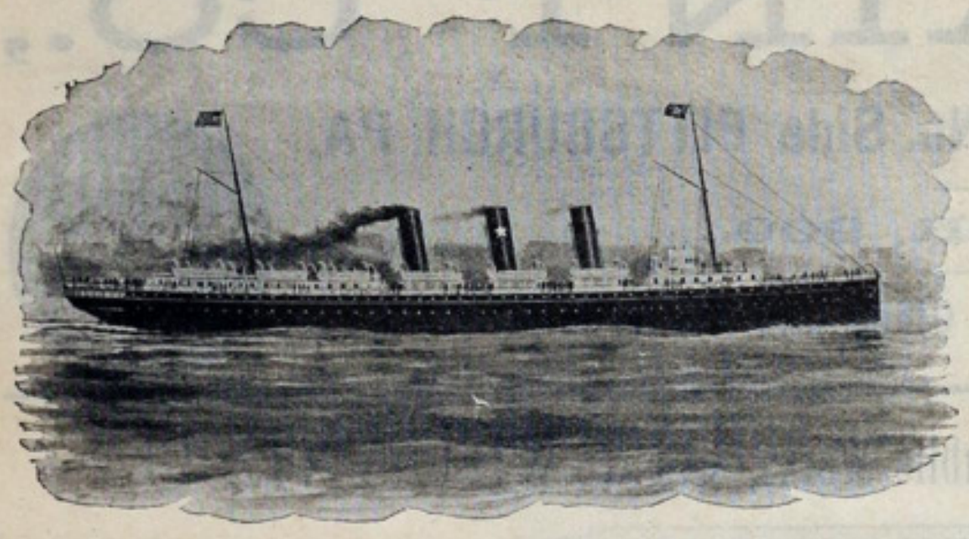
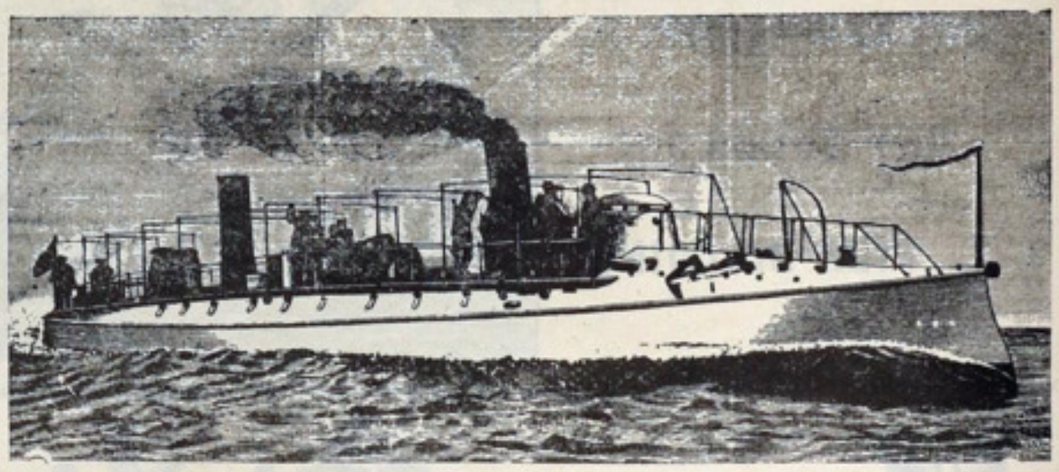


The **BELLEVILLE BOILERS** in the two

GREAT NORTHERN STEAMERS . . .

are constructed of SYRACUSE TUBES. See full account of same, pages 12 and 13 of this issue.



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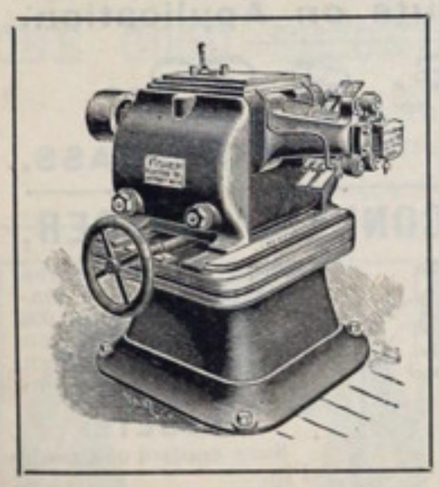
UNITED STATES ENGINEER OFFICE, Telephone Building, Detroit. Mich., April 26, 1893. Sealed proposals for dredging Black River at Port Huron, Michigan, will be received at this office until 2 p. m. on Wednesday, the 31st day of May, 1893, and then publicly opened. Specification blank forms and all available information will be furnished on application to this office. WILLIAM LUDLOW, Major of Engineers, Bvt. Lieut. Col. U. S. A. 11-18



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Going east trains will leave Chicago at 2:30 p. m. and 9:30 p. m., arriving at Buffalo at 6:00 a. m. and 5:00 p. m. respectively, each train including through sleeping cars to New York via both the West Shore and the Reading systems and to Boston via the Fitchburg and West Shore roads. In addition to these there will be a train between Chicago and Cleveland, leaving Chicago about 8:00 a. m. and one between Cleveland and Buffalo, leaving Cleveland at 7:00 a. m. and arriving at Buffalo at 2:00 p. m. All trains will run daily and superb dining cars will form part of their equipment.

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